Principles and Practice
OF
Chiropractic

For the Use of Students and Practitioners

THIRD EDITION REVISED AND ENLARGED

BY
ARTHUR L. FORSTER, M.D., D.C., Ph.C., M.A.

Professor and Head of the Department of Chiropractic, National College of Chiropractic; Author, "Practice of Chiropractic," "The White Mark," "The Chiropractic Catechism," Etc.; Editor, "National Journal of Chiropractic."

WITH ILLUSTRATIONS

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DEDICATED TO

William Charles Schulze, M.D., D.C., Ph.C.

IN ADMIRATION OF HIS VALUABLE WORK IN
PHYSIOLOGICAL THERAPEUTICS AND
AS A TOKEN OF MY SINCERE
REGARD AND ESTEEM

PREFACE TO THE FIRST EDITION

This book has been written primarily with a view to presenting the subject of Spinal Adjustment along strictly scientific lines. While the theory of Spinal Adjustment has been repeatedly propounded, and its value as a remedial agency undeniably proved by the clinical results of those who have preceded me in this field of endeavor, I think this work will constitute a step forward in placing this subject upon a scientific basis, and prove for all time that it rests upon facts that are irrefutable.

In common with most advances in the art of healing, Spinal Adjustment was first used in a purely empirical manner, its own advocates being unable to explain satisfactorily the results produced through its use. Careful investigation, however, has revealed the premises and furnished the data which rescue this form of treatment from the empiricism of the past and put it upon a substantial basis.

The greatest obstacle to the general adoption of Spinal Adjustment has been the inherited belief that vertebral subluxations are impossible. This belief has been successfully shattered by a large amount of experimental work, particularly upon the cadaver. In this work I was ably assisted by Dr. Erik Juhl and I hereby make grateful acknowledgment of this gentleman's great help in this connection.

The first section of this work deals with the principles of Chiropractic. For verification of the different physiological facts enumerated in this part of the book I have referred quite extensively to the American Text Book of Physiology and Kirk's Physiology.

The anatomy and physiology of the nervous system, and the spinal nerve influence upon the various organs, are an essential feature in a work of this nature, and must be thoroughly understood in order to appreciate the modus operandi of Spinal Adjustment.

The section on Vertebral Mal-alignment shows the direct causes of subluxation of the vertebrae, and further shows the manner in which they may be produced reflexly. The exact manner of such reflex production of Spinal Lesions is of vital importance to a comprehension of the fact that pre-existing subluxations not only cause disease but may themselves be produced by disease.

The section on Spinal Analysis presents this important subject in a manner which should make it of practical value to students and practitioners. The classification of the various forms of vertebral subluxations is, we think, logical and therefore easy to remember.

In the section giving the various holds used in the adjustment of subluxations, those which have been found after long usage to be the most practical have been presented. These holds have been given a new and distinctive nomenclature; they have been described briefly and concisely, and they are accompanied by original illustrations, which have been prepared with great care. While these holds are not all original and have become common property, still it is only meet that our indebtedness to the pathfinders in this field of work should be expressed. Lack of space forbids detailed reference in every instance, and this inadequate way of acknowledging a heavy debt must suffice.

The section dealing with the Practice of Spinal Adjustment we consider a valuable feature both for the practitioner and for use in schools.

I am under deep obligation to my friend and colleague, Dr. W. C. Schulze, without whose encouragement and assistance the publication of this book would not have been possible.

My thanks are also due Miss Amy Schultz for valuable assistance in the preparation of the manuscript of the last section of the book.

The illustrations are in the main original, and at a sacrifice of artistic finesse for technical accuracy I have executed them myself. For all others credit has been given.

A. L. F.

Chicago, May, 1915.

PREFACE TO THE SECOND EDITION

The five years that have elapsed since the publication of the first edition of this work have witnessed a degree of progress that far exceeds the record of the preceding twenty years of Chiropractic History.

The personnel of the profession has doubled itself. One-half the states have accorded Chiropractic legal recognition. Other schools of healing have withdrawn much of their opposition. The public has placed its stamp of approval and approbation. The science of Chiropractic has won a secure place among the learned professions.

That the first edition of this work contributed much to further the progress of Chiropractic goes without saying. It has been the means of bringing many into the ranks of the profession. It has given the profession a title to statutory recognition. It has contravented the opposing views of other schools of healing. It has presented Chiropractic to the world on a basis that carriers conviction. It has placed Chiropractic upon an unassailable scientific foundation.

The second edition of this work is presented to the profession in the hope that it will be accorded the same generous reception that was given the first edition. The work has been revised in a number of respects, the most notable revision being that of the various forms of subluxation of the vertebrae. Extensive study and research have disclosed a number of misconceptions relating to the nature of vertebral subluxations and the result of these studies is herewith given. A number of new illustrations have been added. Other minor alterations have likewise been made.

My thanks are due the profession for the splendid endorsement given the first edition. The unusual compliment paid this work in its adoption by many of the Schools is particularly gratifying and has spurred me on to greater effort to produce in this, the second edition, a text-book on Chiropractic worthy of their entire confidence.

A. L. F

Chicago, July, 1920.

PREFACE TO THE THIRD EDITION

Frequent revisions of a text-book in Chiropractic are necessary if it would adequately present the latest refinements of this rapidly evolving science and art. The exhaustion of the second edition in less than three years gives the author an opportunity to offer the profession the results of late study and research contemporaneous with their completion, a fact that greatly enhances the value of a work of this character.

The most prominent outgrowth of this study and research has been a more scientific exposition of the principles of Chiropractic, and their acceptance by an ever-enlarging circle in the profession. Many of the fallacies of socalled chiropractic philosophy have been exposed, and dogmatic pronouncements replaced by scientific proofs.

Subjects that have received the greatest attention include the innate intelligence theory, retracing, nerve tracing, the meric system, chiropractic bacteriology and specific adjusting. The result of studies on these topics is herewith presented for the first time *in toto*.

Other features that distinguish this edition from its predecessors are treatises on incompatible adjustments, and on the *modus operandi* of adjustments. The chapters on the origin of Chiropractic, chiropractic diagnosis, and the chiropractic etiology of disease have been enlarged. The fourteen chapters of the last section have been extensively revised. The section on Technic has been enriched by the substitution of improved holds for some that have become virtually obsolete.

The general purpose of the work remains unchanged. It is designed as a text-book for students, and as a guide and reference for practitioners. Its third edition is offered the profession with the assurance that it is in every sense a new book. The elaborate revisions and extensive additions that distinguish this from the preceding editions immeasurably increase the value of the work.

The author takes this opportunity to express his gratitude to the profession for the splendid reception accorded previous editions of this work, not overlooking the endorsement given it by the many schools that have adopted it as their official text on Chiropractic.

A. L. F.

Chicago, June, 1923.

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Principles of Chiropractic

CHAPTER I

The Origin of Chiropractic

Chiropractic (G. *cheir*, hand and *praktikos*. efficient) is based upon five fundamental premises: (a) that a vertebra may become subluxated; (b) that this subluxation induces impingement of the contents of the intervertebral foramen; (c) that, as a result of this impingement, the irritability of the corresponding segment of the spinal cord and its connecting spinal and autonomic nerves is reduced, and the conduction of the nerves is impaired; (d) that, as a result thereof, certain parts of the organism are deprived of their innervation in whole or in part, and become functionally or organically diseased or predisposed to disease; and (e) that adjustment of a subluxated vertebra removes the impingement of the structures passing through the intervertebral foramen, thereby restoring to diseased parts their full quota of innervation, and rehabilitating them functionally and organically.

Nothing definite is known as to when, where, or by whom the principles upon which chiropractic is founded were first employed. Chiropractic, as it is known today, was founded by D. D. Palmer in 1895. He did not, however, discover the principles on which the art and science of Chiropractic is based. Nor was he the first to adjust misplaced vertebrae. What he did was to systematize adjustment of misplaced vertebrae and give the system the name Chiropractic which was suggested to him by Rev. Samuel H. Weed in 1896.

D. D. Palmer at no time claimed credit for having discovered the principles on which adjustment of misplaced vertebrae is based, nor of having been the first to adjust misplaced vertebrae. His first knowledge of this method

of curing disease was obtained from a Dr. Atkinson who had tried for many years to do what D. D. Palmer later accomplished—coördinate these principles and practices into a new and distinct school of healing.

Some writers contend that D. D. Palmer discovered both the principle and practice of replacing misplaced vertebrae. They further relate that this discovery was accidental and the method employed crude. The story as generally related is to the effect that D. D. Palmer, at that time a magnetic healer, was consulted by a negro suffering from deafness; Palmer found a lump on the patient's neck, concluded that it was a misplaced vertebra, and replaced it. The patient's hearing was restored. Palmer is supposed to have concluded that the misplaced vertebra which he had adjusted was the cause of the patient's deafness, and is presumed to have stumbled upon this discovery.

It is a fact, however, that D. D. Palmer did not become acquainted with the principle of adjustment of misplaced vertebrae on the occasion that he adjusted Harvey Lillard. He had heard of misplaced vertebrae being the cause of disease long before that time. He simply applied the principle in the negro's case and obtained the hoped-for result. The following is D. D. Palmer's own account of the case as given on page 18 of his book, The Chiropractor's Adjuster:

> "Harvey Lillard, a janitor in the Ryan Block, where I had my office, had been so deaf for 17 years that he could not hear the racket of a wagon on the street or the ticking of a watch. I made inquiry as to the cause of his deafness and was informed that when he was exerting himself in a cramped, stooping position, he felt something give way in his back and immediately became deaf. An examination showed a vertebra racked from its normal position. I reasoned that if the vertebra was replaced, the man's hearing should be restored. With this object in view, a half hour's talk persuaded Mr. Lillard to allow me to replace it. I racked it into positon by using the spinous process as a lever and soon the man could hear as before. There was nothing 'accidental' about this, as it was accomplished with an object in view, and the result expected was obtained. There was nothing 'crude' about this adjustment; it was specific so much so that no Chiropractor has equaled it."

The foregoing is sufficient evidence to show that the principles of Chiropractic were not discovered on the occasion that D. D. Palmer adjusted Harvey Lillard. He had long before become familiar with the principles and practice of adjustment of misplaced vertebrae, and simply applied them in the negro's case.

Further light on the question of Palmer's discovery of the principle and practice of spinal adjustment is offered by the following extract from pages 11 and 12 of his book, The Chiropractor's Adjuster. He says:

> "The basic principle, and the principles of Chiropractic which have been developed from it, are not new. They are as old as the vertebrata. I have both in print and by word of mouth, repeatedly stated, and now most emphatically repeat the statement, that I am not the first person to replace subluxated vertebrae, for this art has been practiced for thousands of years. I do claim, however, to be the first to replace displaced vertebrae by using the spinous and transverse processes as levers wherewith to rack subluxated vertebrae into normal position, and from this basic fact, to create a science which is destined to revolutionize the theory and practice of the healing art. . . . . .
>
> "My first knowledge of this old-new doctrine was received from Dr. Jim Atkinson who, about fifty years ago, lived in Davenport, Iowa, and who tried during his life-time to promulgate the principles now known as Chiropractic. He failed, not because the principles were erroneous, but on account of the intellectuality of that time was not ready for this advancement.
>
> "Dr. Atkinson has frequently informed me that the replacing of displaced vertebrae for the relief of human ills has been known and practiced by the ancient Egyptians for at least 3000 years.
>
> "Recently I had the honor and pleasure of entertaining my old friend W. J. Colville, the well-known traveler, author and inspirational speaker, who gave me the following typewritten information concerning the history of the principles which had been given to me by Dr. Atkinson. These axioms, rediscovered and known as Chiropractic, were also known and practiced by Aesculapius and his followers 420 years before the Christian era. . . . .
>
> "During my visit to Paris, in 1895, as the guest of Lady Gaithness, the famous author of 'The Mystery of the Ages' and many valuable works, it was my privilege to meet many peculiar and distinguished persons, among whom, and the

> most interesting of all, were some members of an Occult Society which made a specialty of Healing Ministrations. Among the methods employed by these extraordinary representatives of a very ancient cult of Aesculapius was one closely resembling Chiropractic."

From the foregoing it is evident that D. D. Palmer did not accidentally discover the art of adjustment of misplaced vertebrae, but that the principles upon which this art is founded were known and applied thousands of years ago. Thus Egyptologists relate that the replacing of misplaced vertebrae was practiced by the ancient Egyptians many years before Christ. Evidence also abounds to show that the early Greek physicians likewise employed this method of curing disease. Still others state that during a sojourn among the Indians they were told by them that methods similar to the chiropractic adjustments of the present day were in common use among their tribe for as long as these aborigines could remember. It is furthermore commonly known that among the Bohemians spinal adjustment has been used for generations.

Clouded in obscurity as is the origin of the principles of Chiropractic, nothing is known as to the manner in which these different peoples first became acquainted with the beneficial effects of adjustment of misplaced vertebrae. Doubtless, however, its value as a curative measure was first ascertained in connection with its employment for the relief of sprains and other injuries of the vertebral column. Patients who were being treated for the relief of such vertebral lesions were very likely suffering from coincident affections of various kinds. And in such cases it was undoubtedly observed that, many times, the associated diseases were likewise relieved by the manipulation of the vertebrae. When it is recalled that most agencies that have contributed to human progress and betterment were discovered by merest accident, it is not unreasonable to assume that the knowledge of the beneficial action of spinal manipulation was gained in a similar manner.

There is no question that the Bohemians have applied the principles of spinal adjustment to the relief of disease more extensively and consistently than any other nation.

It is not at all uncommon to be told by Bohemians that their grandparents employed a technique of replacing misplaced vertebrae that is very similar to the present day chiropractic thrust. True, they are unacquainted with the *modus operandi* of adjustment, and simply apply it because they have come to know that in so many instances its use is followed by cure of the ailment from which the patient is suffering. The effect was not altered by the fact that the procedure employed may be crude and unscientific. They obtained the same result, namely, they restored the ligaments of each side of the vertebral column to balanced tonicity; they reduced the subluxated vertebrae and thus relieved the impingement upon the nerves and vessels passing through the intervertebral foramina. The fact that spinal adjustment was used in an empirical way for many years before it was placed on a scientific basis has its counterpart in many phases of the healing art.

In common with numerous measures outside the realm of recognized procedure in the treatment of disease Chiropractic remained unrecognized for many years. Nothing was written concerning this method. It was erroneously looked upon in those days as a superstitious fancy, just as it is today still mistakenly regarded by some physicians as a form of quackery. As a result the medical profession would have nothing to do with it—did not even investigate it. In consequence, what was destined to become a most valuable acquisition to the armamentarium of those engaged in the art of healing, remained unnoticed by those best fitted, in those days, to place it upon a scientific basis.

There is nothing surprising in this when one stops to consider with what extreme difficulty he is beset who desires to receive recognition for some new method of therapy. Many, indeed, are averse to adopting anything new no matter what possibilities it holds forth. And many a well meaning physician will promptly condemn any method without granting it an opportunity to demonstrate any possible merit it may possess.

While the above may seem like a digression from the subject in hand, it is deemed worthy of mention for the reason that it throws a strong light on the cause of the

long delay in the adoption of the principle on which Chiropractic is founded. Doubtless its empirical origin also contributed largely to its failure of general adoption and recognition.

Again, when first introduced into this country it was sponsored by men of little or no education. And, on seeing instances of what it accomplished, its advocates jumped to the conclusion that adjustment of misplaced vertebrae would cure all diseases. Quite naturally such extravagant claims were met by severe condemnation at the hands of the regular medical profession. D. D. Palmer, himself, did not escape becoming over-zealous and made the mistake of overrating the merit of adjustment of misplaced vertebrae. Undoubtedly his enthusiasm coupled with his lack of preliminary training were responsible therefor. Certainly it goes without saying that had he possessed a more extensive knowledge of the sciences underlying the art of healing, some of the views which he advanced would never have been made. He claimed that all disease is due to subluxation of the vertebrae and that all diseases could be eradicated by adjustment of the vertebrae. Naturally such views could not be subscribed to by any one with a liberal training in the fundamental sciences. Happily, however, broader views and scientific knowledge have replaced the empiricism and misstatements of the past. Still to D. D. Palmer must be given the credit for creating a new school of healing founded on the principle of replacement of misplaced vertebrae, and furnishing the impetus which has carried Chiropractic to a worldwide recognition of its merits in the alleviation of disease.

Since the year 1897, when the first student enrolled at D. D. Palmer's school, up to the present day, the history of Chiropractic has been one of unbroken progress. And this can be ascribed to only one fact—that it possessed unusual merit. Had it lacked any measure of merit it could not long have survived the merciless attacks made by scientific men against the errors that permeated its philosophy in the early years of its development. It cannot be denied, however, that even though it possessed merit, persistent exposure of the many unscientific pronounce-

ments of its first teachers could have materially retarded its progress. Fortunately this was circumvented by a gradual elimination of the erroneous claims of early days and their substitution with a philosophy in accord with all scientific truths. Founded on principles that are incontrovertible and fulfilling its promises in practice, it has become invincible, and stands today recognized by millions as the most valuable single agency in the art of healing.

CHAPTER II

The Theoretical Basis of Chiropractic

As stated at the commencement of the preceding chapter, Chiropractic is founded on the theory that vertebrae may become subluxated, that is to say, that a slight misplacement of their opposing articular surfaces may occur.

As a consequence of this subluxation there is produced an impingement of the nerves and vessels which pass through the intervertebral foramen corresponding to the vertebrae involved in the misplacement. This impingement is produced by the altered position of the margins of the intervertebral foramen.

In order to appreciate exactly how such misplacement of the vertebrae could produce impingement of the structures transmitted by the intervertebral foramen, a study of the parts of the vertebra which enter into the formation of the intervertebral foramen is necessary. A portion of the circumference of the foramen is formed by the intervertebral notches which are concavities on the upper and under surfaces of the pedicles. The pedicles are two short, thick processes of bone, which project backward, one on each side, from the upper part of the body of the vertebra, at the line of union of its posterior and lateral surfaces. The intervertebral notches are four in number, two on each side, the inferior ones being generally the deeper. When the vertebrae are articulated the notches of each contiguous pair of bones form the upper and lower border of the intervertebral foramen. The articular processes of the vertebrae are nearly vertical, and project from the upper and lower surfaces of the pedicles. A part of the margin of the articular process thus forms a portion of the margin, namely the posterior portion, of the intervertebral foramen. The anterior part of the wall of the intervertebral foramen is formed by the body of the vertebra and the intervertebral disc.

From the above description it is seen that the intervertebral foramen is bounded above and below by the pedicles,

posteriorly by the articular process, and anteriorly by the body and intervertebral disc.

Since the anterior surface of the articular process constitutes the posterior wall of the intervertebral foramen, it can be easily understood how the slightest forward misplacement of a vertebra would cause the articular process to encroach on the antero-posterior diameter of the intervertebral foramen, and press upon the spinal nerve at that point.

In like manner, since the pedicles form the upper and lower walls of the intervertebral foramen, it is at once apparent how an upward or a downward misplacement of a vertebra would cause the pedicles to encroach on the vertical diameter of the foramen. In such a case the spinal nerve is pressed upon by the pedicles, either the lower or upper one, as the misplacement is either upward or downward.

Lastly, since the body of the vertebra forms the anterior wall of the intervertebral foramen, it is clear that a backward misplacement of a vertebra would result in the posterior surface of the body encroaching on the antero-posterior diameter of the foramen, and press upon the spinal nerve.

It is a well known fact that nature permits no spaces in the body to be left unoccupied. Consequently, the intervertebral foramen must not be looked upon as a circular opening with a nerve passing through its center. On the contrary it is entirely occupied by the structures which pass through it. Nature wastes no space, and no cavity or foramen in the entire body is larger than is required for the holding of the structures which it contains or transmits. Thus the intervertebral foramen is only of sufficient size to contain the vessels and nerves which it transmits, and a decrease in the size of the foramen results in a diminution of the space required by the nerves for the exercise of their normal function.

That part of the vertebra which is misplaced and encroaches upon the diameter of the foramen presses upon the spinal nerve. It must be borne in mind that the margins of the intervertebral foramen are not sharp, but smooth and rounded. Consequently the pressure upon the nerve of the misplaced portion of the circumference of the fora-

men does not sever the continuity of the nerve, but results in an impairment of its irritability and conductivity.

When, therefore, as a result of a misplacement of a vertebra, the nerve is impinged, as above described, it is prevented from conveying impulses to those parts which it controls. This opinion is based upon the physiological fact that mechanical applications to a nerve first increase and later lessen and destroy its irritability. Irritability is that property of living protoplasm which causes it to undergo characteristic physical and chemical changes when it is subjected to certain influences called irritants. The term irritants, in speaking of nerves, includes anything which causes the nerve-cell to send an impulse along its branches. Consequently when we say that pressure upon a nerve interferes with its power to transmit impulses we do so in full accord with the further physiological fact that pressure gradually applied to a nerve first increases and later reduces its power to respond to irritants. If the power of a nerve to respond to irritants is lost, it assuredly is unable to carry impulses, for upon its irritability depends its power to generate impulses or convey them.

Assuming then, for the moment, that subluxations really may occur, and that as a result of these subluxations of the vertebrae an impingement of the spinal nerve is produced, chiropractic maintains that disease results in that particular part or organ controlled by the spinal segment involved in the misplacement.

This must follow because the normal function and the organic integrity of every organ and part of the body is dependent upon proper innervation without which health cannot be preserved. The medium through which this state of perfect equilibrium of the various parts of the body is maintained is the autonomic nervous system. This portion of the nervous system is the mechanism which governs every unconscious act of the body. It regulates the proper circulation of the blood, secretion, excretion, and metabolism. This is accomplished by a constant stream of out-going impulses, the existence of which is proven by the fact that under normal conditions both the voluntary and involuntary

muscles are in a state of slight contraction or tonus at all times.

The human organism is regarded generally as a machine made up of various parts. When these parts are functioning as a harmonious whole, health exists. When, on the contrary a lack of balance is present, there is a perversion of function, and what we know as disease develops.

We have said that the regulation of all these various functions of the body economy depends upon a perfect and uninterrupted flow of impulses along the course of the nerves. Any interference with the free and continuous transmission of these impulses; anything, in other words, which diminishes the power of conductivity of the nerves, must be regarded as the true cause of disease. The only place where such interference can logically occur is at the intervertebral foramina, for in no other place along their entire course are the nerves placed in a position where there exists the possibility of pressure upon them of any displaced bony structures.

An isolated organ or viscus will not functionate even though all the functional elements are present and its integrity has not been interfered with in the slightest degree. Of itself it has no power to act, and when separated from the body it becomes an inanimate mass of specialized cells which from that moment forth not only lose their ability to exercise their normal function but their very existence itself, and disintegration rapidly follows. The functional ability of an organ depends upon the vital force inherent in the living organism as a whole, which acts through the medium of the central axis (brain and cord). Here the impulses are generated which govern the activity of the body economy, and these impulses are conveyed along the course of the nerves to every cell. Without these impulses the cell would cease to act and cease to be.

In view of these facts the factors commonly considered as the cause of disease are not the real cause, but merely secondary factors acting or operating by virtue of the presence in the body of conditions which make their activity possible. These conditions are produced primarily by a want of resistance to the invasion of the secondary factors,

as a result of deficient innervation of the part involved. Thus, for example, in pneumonia which is ordinarily considered as being caused by the pneumococcus of Fraenkel, the pneumococcus is not the primary cause of the disease; were this true nearly every individual would "catch" this disease, since we are constantly brought into contact with this organism. There must, therefore, be something which prevents certain individuals from becoming affected with pneumonia, and which makes it possible for others to contract the disease. This something is the resistance of the former and the want of such resistance in the latter. It may be questioned why do some recover from the disease, while others succumb to it. Once again the answer is simply that in the case of the patient who recovers, a sufficient amount of resistance was possessed to overcome the deleterious influences of the microörganism and its toxins. In the case of the patient who succumbed to the disease, this resistance was not present; in other words his bodily state as a whole was such as to make it possible for the secondary factors to obtain a foothold and make their destructive influences possible.

Lack of resistance, then, is the primary factor in the production of disease, since in the face of a perfect resistance the action of the secondary factors becomes impossible. Resistance thus becomes but another term for perfect metabolism, perfect functioning of the organs of the body, and a perfectly harmonious whole. This perfect state of the body economy we have seen depends upon a free and uninterrupted flow of nerve impulses. Anything, therefore, which interferes with the conductivity of the nerves must be considered as being the primary cause of disease. The place at which this interference occurs is at the point where the spinal nerve, and the autonomic fibres in the substance of the spinal nerve, pass through the intervertebral foramen.

In order to appreciate the exact manner in which the autonomic system is influenced by a subluxated vertebra brief consideration of the connection between the cerebrospinal and autonomic nervous systems must be included in this chapter.

The spinal nerve, formed by the union of the anterior

and posterior roots which originate in the anterior and posterior horns of the spinal cord respectively, passes through the intervertebral foramen. After its complete emergence from the foramen it bifurcates into the anterior and posterior primary divisions. The anterior root of the spinal nerve is efferent or motor; the posterior is afferent or sensory. Situated on the posterior root is a ganglion called the spinal ganglion. That portion of the autonomic system with which we are now engaged consists of (1) a series of ganglia, joined to each other by intervening cords, extending from the base of the skull to the coccyx, one on each side of the middle line of the body, partly in front and partly on each side of the vertebral column; (2) of numerous nerve-fibres, which are of two kinds: namely, communicating, by means of which the ganglia communicate with each other and the cerebrospinal nerves, and distributory, which supply the internal viscera and the coats of the blood-vessels. The autonomic fibres are also both efferent and afferent. The efferent or white branches of communication between the ganglia and the cerebrospinal nerves arise in the spinal cord; they pass out in the anterior root, and then into the spinal nerve. Here they join the afferent fibres which originate in the spinal ganglion. These united fibres then pass on into the anterior primary division of the spinal nerve. They leave this, and, now being known as the white rami communicantes, they pass *to* the ganglion of the autonomic cord of the corresponding situation. The afferent branches of communication between the autonomic and cerebrospinal nerves pass *from* the ganglion of the autonomic cord to the spinal nerve and are called the gray rami communicantes. They may extend separately from the white rami, or both kinds of fibres may be contained in a single bundle. The gray rami pass through the anterior primary division of the spinal nerve to the spinal nerve and then accompany it throughout all its divisions. The branches between the ganglia themselves consist of gray and white nerve-fibres, the latter being a continuation of the efferent fibres which pass from the spinal nerves to the ganglia.

Situated in front of the spine, in the thoracic, abdominal and pelvic regions are three great gangliated plexuses. They

are called the cardiac, solar and hypogastric plexuses, respectively. They are made up of nerves and ganglia; the nerves are derived from the gangliated cords and from the cerebrospinal nerves. These great gangliated plexuses send branches to the viscera.

Smaller ganglia are found amidst the nerves in certain viscera, and form additional centres for the origin of nerve-fibres.

The branches of distribution from the gangliated cords, from the great gangliated plexuses, and from the smaller ganglia, supply impulses to the involuntary muscular coats of the blood-vessels, all hollow viscera, and the secreting cells of all glands.

Thus we see that the two systems are interlocked in the most intimate manner. Branches pass from the spinal nerve *to* the ganglion, and *from* the ganglion to the spinal nerve, resulting in a double interchange between them. In this way they really constitute one composite system, and impulses from the brain or cord which are arrested at the intervertebral foramen by a subluxation of a vertebra must of necessity cause disturbances in the parts of the body governed by that segment which is involved in the subluxation.

The foregoing applies exclusively to the thoracic, abdominal and pelvic viscera. How the structures of the head and face are influenced must also be briefly shown.

Each gangliated cord enters the cranium through the carotid canal by an ascending branch. The two cords are united within the cranium by these ascending branches uniting in a small ganglion, called the ganglion of Ribes. The ganglia of the gangliated cords are classed as cervical, dorsal, lumbar, and sacral. We concern ourselves in this connection with only the cervical portion which has three pairs of ganglia. These three pairs of ganglia are classified from their position as the superior, middle, and inferior.

The superior cervical ganglion which is the largest of the three is situated opposite the second and third cervical vertebrae. It is commonly supposed that it is formed by a coalescence of the four ganglia corresponding to the four upper cervical vertebrae. It has five branches, namely, su-

perior, inferior, anterior, internal, and external. These branches form plexuses which send filaments to all the cranial nerves. There is thus formed a connection between the cranial nerves and the autonomic system as intimate as that which we have seen exists between the spinal nerves and the autonomic system. By reason of this intimate relationship it is possible to directly influence the cranial nerves by adjustment of the cervical vertebrae. And it is a clinical fact that in nearly all affections involving the structures of the head and face, such as the ear, eye, nose, and throat, subluxations exist, and that, moreover, adjustment of subluxated vertebrae is followed by a cure or improvement in the particular disease thus produced.

The question which now naturally arises is, does the vertebral subluxation cause enough actual pressure to be brought to bear upon the spinal nerve to inhibit its power of transmitting impulses. This question will be answered in detail in a future chapter. One fact will, however, be mentioned at this time to demonstrate that it is possible for sufficient pressure to occur to impede the flow of impulses along the nerve impinged. The intervertebral foramen of the adult human spine is from 1/6 to 1/4 inch in diameter. The spinal nerve measures 1/12 inch in diameter at its narrowest point, and 1/6 inch at its widest point. It is placed in such a position that it does not come into actual contact with the bony boundary of the foramen at any point. But it can be demonstrated mathematically that its farthest distance from the wall of the foramen is only 1/8 of an inch, while only 1/32 of an inch intervenes between it and the wall of the foramen at the point where it lies nearest the bone. Now, when we consider that in addition to the spinal nerve, the intervertebral foramen also contains blood-vessels, fat cells, and fibrous tissue, it at once becomes apparent that it requires only a very slight movement of the vertebra in any direction to result in sufficient pressure upon the spinal nerve to seriously impair its power of conductivity.

It has been stated by some that empty spaces exist in the intervertebral foramen. This is, however, incorrect both from an anatomical and a physical point of view. The

spaces seen in the foramen when viewed through the microscope do not exist during life as they appear in the section of the foramen prepared for microscopical examination.

In the first place, as previously stated in this chapter, nature tolerates no vacant spaces in the body. What, then, do the vacant spaces seen under the microscope contain when the foramen is *in situ*? Partly distended blood-vessels which, after excision become empty; the remaining portion is occupied by lymph. That the nerve is surrounded by these soft structures affords it no protection, for it must be borne in mind that the pressure which occurs in a subluxation is that of *hard* bone on *soft* tissues.

Another question that frequently arises is that referring to the absence of pain at the point of subluxation. It must not be supposed that simply because no pain is present at any point along the spine that no abnormality exists along the course of the spine. To do this would be exactly the same as to maintain that because no pain exists at the hip-joint no lesion exists there. It is a well known fact that pain is very often referred to a point along the course of a nerve at some distance from the seat of the lesion which produces the pain. Thus in many cases of hip-joint disease pain is referred to the knee; and how very often is this fact not overlooked? In like manner, the pain which is really produced at the place where the nerve is impinged is interpreted by the patient at the terminals of the nerve which is impinged, and not at the seat of its production, namely, the intervertebral foramen.

That subluxations in certain segments of the spine produce certain diseases is attested to by the fact that upon an accurate determination of a subluxation in a certain section of the vertebral column an exact knowledge is gained as to what particular system or organ of the body is diseased. Naturally the exact nature of the disease cannot be determined in this way. Thus, for example, when the liver is affected—it may be accurately determined that there is an abnormal condition of that organ by finding the fourth and eighth dorsal vertebrae subluxated, but whether this abnormality is cancer or congestion of the liver requires a direct examination of the organ itself.

In conclusion, chiropractic maintains that by a careful and painstaking examination of the vertebral column as a whole, and by a palpation of the vertebrae individually, the exact nature of a subluxation can be determined. Possibly the most convincing evidences that misplacements really exist are these: upon adjustment of a subluxated vertebra it is noted that the same condition which was felt before the vertebra was adjusted is no longer present. To illustrate: a vertebra is found to be misplaced laterally; the proper chiropractic thrust is applied for the reduction of this lateral misplacement; the vertebra is then palpated again, and is found to be in perfect alignment. This is especially true in recent subluxations. Naturally if a vertebra has been misplaced for a number of years and has adapted itself to its new habitat and is bound into place by adhesions, only slight correction follows each adjustment. But a change in the position of the vertebra is readily seen after ten or twelve adjustments provided there is no distortion of its centrum.

Another evidence that subluxations exist and produce the effects ascribed to them is the clinical fact that, conditions which existed before an adjustment of the vertebrae, disappear and a return to normal results.

The nature of the subluxation being determined, the proper thrust is applied, using the spinous or transverse processes as levers. This thrust, by virtue of its spontaneity, replaces the vertebra in its proper position. Thus the size and form of the intervertebral foramen is again made normal. The mechanical pressure at the foramen is removed and a free and uninterrupted flow of impulses along the nerve is made possible.

William Jay Dana, B. S., says: "A spine can stand a tension of 70 pounds. Such being true, it can easily be shown mathematically that it would only take a blow with a velocity of five feet a second, given by a man who could put ten pounds of his weight behind his adjustment, in order to move a vertebra one-sixteenth of an inch. This kind of a blow is obviously within the capacity of any average man."

From all the foregoing it is evident that chiropractic

does not deal with the effects of a disease process. It does not guess, surmise, or theorize. It recognizes the true and primary cause of disease and relieves that cause. It is founded on anatomical and physiological facts. Its action is specific, scientific, and unfailing.

CHAPTER III

The Anatomical Basis of Chiropractic

Probably the chief reason why so many have thus far declined to accept vertebral subluxations as a possible factor in the production of disease is because of the opinions of the anatomists of a century ago, and of many who have followed in their wake. These anatomists have continually taught that while a certain amount of motion between individual vertebrae is possible, a misplacement of a vertebra is impossible.

There are three chief reasons for this opinion having been formed and adhered to: (1) The main reason why misplacements of the vertebrae were so long considered as being impossible is the fact that they are surrounded and held in position by numerous ligaments, the natural tendency of which is to bind the individual vertebrae so firmly in place that any movement beyond that necessary for normal movements of the spine should be impossible without fracture. (2) It has been considered impossible for vertebral subluxations to exist on account of the configuration of the surfaces of the articular processes in relation to each other. (3) Failure to discriminate between a subluxation and a dislocation has been an important factor in the want of recognition of the possibility of subluxation of the vertebrae.

We will now consider each of these points, and show wherein they fail to disprove the possibility of subluxation of the vertebrae.

Some works on anatomy make the statement that if a team of oxen were placed at one end of a spinal column, and another team at the other end, both pulling in the opposite direction, separation of the vertebra would not occur. This may be perfectly true but it would not prove that misplacement of the vertebrae could not be produced by forces applied in other directions than tension. The spine "can withstand tremendous stresses perfectly." Considering the spine

in tension, we know that a child can be lifted by the head and suffer no injury; the spines of aerial acrobats are constantly in tension and they have perfect coördinative control, are constantly swinging by the hands, feet, knees, or teeth and supporting one or two of their fellows. Stretching machines have shown that 750 pounds can be maintained with benefit. (Dana) But tension, and compression, which is the opposite to tension, are two very different things. Tension tends to increase the calibre of the intervertebral foramina, in fact actually does so, for it can be demonstrated that following tension of the spine it is longer than before. Compression, on the contrary, diminishes the calibre of the intervertebral foramina by lessening the length of the spine as a whole. Whether the vertebrae can be moved apart or not makes very little difference, therefore, from a clinical standpoint. And, further, as will be shown later on, experiments on the dead spine are no criterion by which to draw conclusions regarding the living spine. The conclusion drawn from the fact that tension of the spine does not produce misplacement of the vertebrae is erroneous, for the reason that simply because a vertebra cannot be misplaced by that means, it does not follow that misplacements may not occur in other directions, or be produced in a manner other than that recounted above.

The great strength of the ligaments surrounding the vertebrae is offered as a reason for the impossibility of subluxations taking place. Superficially considered, this view seems plausible, for we know that the vertebrae really are surrounded by many powerful ligaments, which, all conditions being equal, should prevent any misplacement of the vertebrae. But just here this theory disproves itself, for conditions are not always equal. Were the ligaments unyielding, inanimate bands, never changing, and always of the same degree of contraction on each side of the vertebral column, any misplacement of the vertebrae sufficient to produce serious consequences would be impossible. But these ligaments are vital structures, constantly changing, now contracted and again relaxed. At times the ligaments on one side are more contracted than those of the opposite side, as a result of external or reflex irritation. As examples

of the production of contraction of muscles by irritation the following may be cited: Cold air striking the surface of the body causes the tiny muscles surrounding the pores of the skin to contract. Striking the biceps muscle a quick blow and noting the local contraction at the exact spot struck also illustrates the production of muscular contraction by irritation. These are both examples of external irritation. As an example of reflex irritation acting to produce muscular contraction, the spasmodic contraction of the musculature of the intestine produced by the presence of gas may be noted.

These same principles may be applied to the muscles and ligaments of the spine, and will be fully discussed in the section dealing with vertebral malalignment.

It was stated above that the ligaments of one side of the spine may at times be more contracted than those of the other side. This would naturally tend to draw the vertebra with which these ligaments are connected toward the side on which the contracted condition of the ligaments exists. Were the ligaments of each side equally contracted, there would be a perfectly balanced condition and misplacements of the vertebrae would be impossible. It is because of this lack of balance that subluxations may be produced, and it is this contingency which anatomists have failed to take into consideration.

The musculature of each segment of the spinal column is supplied by outgoing nerve-fibres in the posterior division of the corresponding spinal nerve. In a reflex act the outgoing impulse passes to this branch of the spinal nerve. When the stimulus at the periphery which excites the reflex act is applied on one side of the median plane, the responses first appear in the muscles of the same side; and if the stimulus is slight, they may appear on that side only. The incoming impulses are therefore first and most effectively distributed to the efferent cells located on the same side of the cord as that on which these impulses enter. In the peripheral system the nerve-impulse, when once started within a fibre or axone, is confined to that track and does not diffuse to other fibres running parallel with it, *but it does extend to all the branches of that axone, whatever their distribution.*

As a result of this physiological fact, the first response to the outgoing impulse of a reflex act will be a contraction of the muscles and ligaments of the spine on the side at which the ingoing impulse entered the cord, since these muscles and ligaments are supplied by the efferent fibres in the posterior division of the spinal nerve, which is the first branch given off from the spinal nerve.

Physiologically, a muscle that is repeatedly stimulated by nerve-impulses finally reaches a state of tetanic contraction, that is to say, if the impulses are continuous, the muscle finally remains in a permanently contracted condition. We know that the act of defecation is reflexly produced as a result of efferent nerve-impulses to the muscles of the bowel. These efferent impulses are first excited in the cord in response to afferent impulses from the bowel, produced by stimulation of the nerve-endings in its walls by the presence of feces. Since the efferent impulses extend to all the branches of the efferent nerve, each such outgoing impulse also produces a slight contraction of the muscle in that segment of the spine, and on the same side on which the ingoing impulses entered.

If instead of the mild normal afferent impulses there should be continuous strong impulses, as a result, for example, of an inflammatory condition of the intestine, there will be a continuous flow of efferent impulses and the mild contractions of the muscles and ligaments of the spine will be replaced by continuous contractions.

In like manner there are numerous ways in which different spinal segments are affected, depending on the origin of the afferent impulses. We thus see that reflex action is constantly going on, and that, therefore, the musculature of different spinal segments is seldom if ever in a state of balanced contraction on each side. If this contraction on the one side is continuous, the corresponding vertebra must inevitably be drawn toward that side. We find, therefore, that although the ligaments of the spine are strong enough to hold the vertebrae in proper position, if the potential strength of one side be increased by contraction of the ligaments the vertebrae will be drawn to that side.

As to the second of the reasons adduced for the impossi-

bility of subluxation of the vertebrae, namely, the configuration of the articular processes, this opinion is based on comparison with animals and a study of the surfaces of the articular processes in the human spine.

Studied from a purely mechanical viewpoint, the error in these conclusions becomes at once apparent. First of all, not only are the articular processes of quadrupeds constructed differently from those in man, they are also placed in a different plane; that is to say, they are placed in a horizontal position in animals, while in man they are in a vertical position.

Let us take for example the dorsal vertebrae. By studying a group of these vertebrae, it may be seen at a glance how comparatively impossible it would be for a subluxation to occur there while the body is in the horizontal position, and how easily possible it is for the subluxation to occur with the body in the vertical position.

The human spine has been compared with that of a cat to show that subluxations are impossible owing to the shape and placement of the articular processes. The human spine and that of the cat are, however, very different. In the cat, the articulations between the vertebrae permit of the greatest flexibility, there is great freedom of movement, not alone of the spine as a whole, but also of the individual vertebrae with each other. In man, on the contrary, while the spine as a whole is comparatively flexible, movement between any two vertebrae is very much restricted. As a result of this difference in the mobility of one vertebra upon the other, it is evident that, when a slight misplacement of one vertebra upon another is brought about in a cat, it is at once rectified, while in man it tends to persist.

Many diseases and conditions peculiar to the human being have been proven beyond doubt to be dependent upon the vertical position assumed during his waking hours. These conditions are analogous to those which occur, for the same reason, in the spine. Thus we may consider, for example, hemorrhoids; it is well known that the hemorrhoidal veins in the lower rectum have no valves, as have the veins of the extremities; it was simply because these veins were originally designed by nature with a horizontal

position in view. Naturally, in this position the return flow of the blood to the heart would readily occur, which is not true of the veins in the vertical position, and consequently no valves would be required there. Owing to the fact, however, that during so many of our waking hours we are in a vertical position, the blood tends to gravitate toward the most dependent portions, with the result that the hemorrhoidal veins become pouched and dilated, which condition is known as hemorrhoids.

Another illustration of the anatomical basis of abnormal conditions which is a counterpart of the anatomical basis of the production of vertebral subluxations are uterine disorders, especially malpositions. A study of the arrangement and points of attachment of the uterine ligaments, which exist for the purpose of holding the uterus in position, shows that these ligaments fulfill their purpose best when the body is in the horizontal position. In proof of this fact, note how quickly retroversion of the uterus is rectified by having the patient assume the knee-chest position for a half-hour each day. It is because the uterine ligaments hold the uterus in the vertical position for which they are not designed that anteflexion is so common in girls. It is also on account of the likelihood of weakening of the ligaments during pregnancy that retroversion follows childbirth. Lastly it is for this reason that operations upon the uterine ligaments for the correction of uterine displacements are so uniformly unsuccessful.

If the above hypothesis, namely that the vertical position is responsible, on account of the anatomical construction of those parts, for the production of hemorrhoids and uterine malpositions is true, it can be with equal reason applied to the vertebral column, since a study of its construction from a mechanical viewpoint shows clearly that it is originally designed for a horizontal position and not for the vertical. Consequently, when the vertebral column is placed in the vertical position—when a "beam" becomes a "column"—slight separation of its component parts is likely to occur.

It may be questioned by some: If the spine is constructed for the horizontal position, what is the need of the

intervertebral cartilaginous discs, which are considered to exist for the purpose of preventing jars to the vertebral column? Furthermore if they were formed since the spine has assumed an upright position, why have not the articular processes also had time to change to meet the changed requirements put upon them? This can be answered very readily, by calling attention to the fact that the discs are far from being merely for the purpose of preventing jarring of the spinal column. They are present for the purpose of acting as hinges between the vertebrae, and it is their elasticity which gives the spine whatever mobility it has. Were these "hinges" not present there would be possible no movement between the vertebrae. Were there no cartilage interposed between the bodies of the vertebrae, the slight movement between the bare bone would soon cause the bones to wear away. It has its counterpart in all joints (and the vertebral articulations are joints) which are lined with cartilage.

In this connection, let us quote a few extracts from an article on this subject by an engineer, William Jay Dana, B. S. "The spine is used as a column, while it is designed to serve as a beam. As a column it is far from ideally efficient, is made up of twenty-four vertebrae held together by ligaments, muscles, etc., and separated by cartilaginous pads, which are easily compressed. When a spinal column is suspended horizontally all the vertebrae lock with one another, the zygapophyses being in perfect articulation. When held vertically the vertebrae tend to collapse and to form imperfect articulations, as there are no osseous checks—nor ligaments strong enough to keep the spine in perfect alignment when vertical; moreover the loading on the column is eccentric, the center of gravity of head and thorax is outside the center line of the column; this means the vertical column always has a load on it tending to pull it downward; to overcome this there are powerful muscles along the back. The result is the column becomes curved at two points to compensate for the eccentric load it has to support. These curves due to deflection are parabolic. Loads carried upon the head produce peculiar types of back, resulting in curvatures, cretinism, thyroidism, and similar

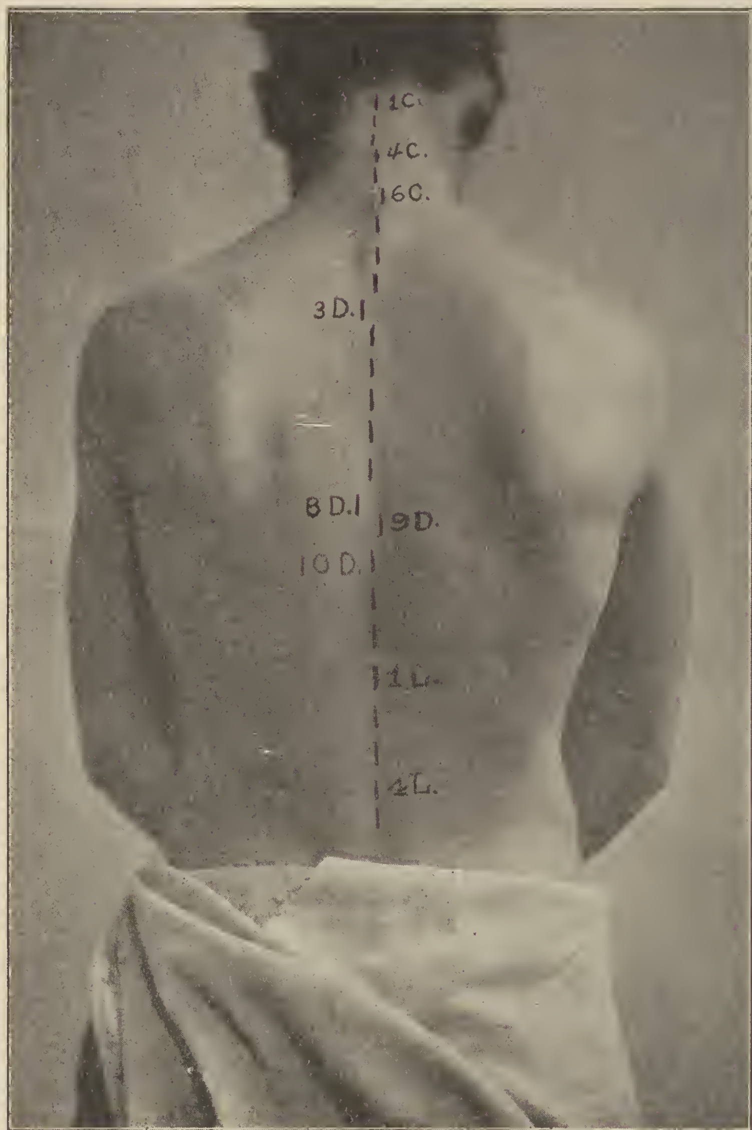

Fig. 1

diseases which previously had not a satisfactory etiology. The cervicals, being the weakest, give way first; hence we see the thyroid type in European mountainous districts, where drinking water has been erroneously accused of causing cretinism, etc. The lower cervical vertebrae become subluxated, so that adjustments here relieve thyroid troubles. Any muscular contractions approximate the vertebrae or pull them out of line if daily persisted in; hence, occupational diseases. Every motion causes a pose or attitude; a persistence of attitude causes a subluxation or a tendency thereto.

"Besides tension and compression there are two other forces acting through the spine, namely shearing (slipping) and torsion (turning). The whole argument rests upon whether the vertebrae can slip or slide in respect to one another. We know that in turning the head and trunk with respect to the hips, that the vertebrae twist slightly in respect to their fellows. Question: Can a condition occur in which twisting is so great as to cause pressure on the spinal nerves which pass through the lateral openings? Dissection of spinal vertebrae shows such pressure does take place with consequent atrophy or degeneration."

The next question that naturally arises is: Assuming that vertebral subluxations may occur, does enough misplacement occur to produce pressure upon the structures passing through the intervertebral foramina? This question has been answered at length in the preceding chapter, and leaves little to be said. It must be remembered that it requires very little pressure upon a nerve to destroy its power of conductivity, and that is all that is required to disturb the function of the parts which that nerve supplies.

That nature recognizes the tremendous importance of maintaining the normal calibre of the intervertebral foramina she demonstrates in numerous ways. For example, examination of spines in osteological collections of the National College of Chiropractic shows how the exostoses, where present, are so arranged that they protect the intervertebral foramen from becoming completely occluded, as the vertebrae collapse. Again, in old age, when settling of the spine occurs, and there comes the danger of complete

Fig. 2

closure of the intervertebral foramina, nature recognizes this danger, and the spine becomes bent forward, and the back parts of the vertebrae are thrown apart to prevent this contingency.

Comparison of the effect of pressure of the margins of the intervertebral foramen upon a nerve has been made to the shutting off of the flow of water through a hose, to the stopping of the current of electricity in a wire, and to many other similar examples. Such examples are misleading, and prove nothing because the exact nature of the conduction process is not understood and bears no similarity to the examples noted. All that is positively known is that pressure upon a nerve will prevent conduction of impulses by it, and that sufficient pressure to produce this effect may be exercised by the margins of the intervertebral foramina when a vertebra is subluxated. Such pressure need be very slight to block conduction; in fact, the merest touch may suffice to do this.

It is a strange fact that medical students are required to make a minute dissection of the peripheral nervous system to the minutest branches of the nerves, but a dissection of the spine is not required. Probably if such had been required, much that at the present time seems to the average medical man as mysterious would long ago have been made clear. It has remained for the students of spinal adjustment to do this, and the spinal findings, post mortem, reveal the truth of the existence of misplacements of the vertebrae. The figures shown on the accompanying pages are reproductions of photographs taken of a cadaver in process of dissection in the anatomical laboratory of the National College of Chiropractic of Chicago, by the author, with the assistance of the late Dr. Erik Juhl. These illustrations show several important things: first, that subluxations really exist; second, that sufficient misplacement of the vertebrae is present to occasion pressure upon the structures passing through the intervertebral foramina; and, third, that these subluxations may be detected by palpation of the surface of the back.

In reading articles in medical journals dealing with the etiology of various diseases and conditions one is often

Fig. 3

struck with the fact that statements made imply that a spinal lesion must be the basis, yet the simple statement to that effect is never made. Numerous quotations might be given in which it could be shown that the etiological factors given by the authors of those articles are but another name for subluxation of the vertebrae. These writers realize that improper innervation is the basis for many conditions, yet fail to find the key to the mode of production of the faulty innervation, namely pressure upon the spinal nerves by the misplaced margins of the intervertebral foramina through which they pass.

A careful study of these illustrations reveals the interesting fact that the subluxated vertebrae as indicated on the integument in Fig. 1 are shown with the various layers of the muscles of the back removed. In succeeding reproductions the abnormal position of the spinous processes becomes gradually more and more distinct. Finally the narrowed intervertebral foramina are seen corresponding to the seat of some of the spinal lesions.

These figures prove beyond any successful denial that misplacements of the vertebrae, without fracture, are not only possible but actually do exist. These photographic reproductions, while showing the actual narrowing of the intervertebral foramina, cannot show the compression of the vessels and nerves as witnessed directly on the cadaver. Another interesting fact brought out in the cadaver was the ease with which the handle of the scalpel could be introduced into the foramina corresponding to vertebrae which were not subluxated, and the impossibility of introducing it into those foramina whose component vertebrae were misplaced.

It might be stated that there were present at the dissection of the cadaver which revealed these findings some who had more or less misgivings relative to the actual existence of vertebral subluxations. No one, however, could deny the truth of what his eyes witnessed.

The accompanying illustrations, being reproductions of photographs of the spinal column, are as convincing as the direct dissection of the cadaver was, and prove once more

Fig. 4

that subluxation of the vertebrae is no longer a theory but a fact.

By palpation of the vertebral column of the cadaver the following subluxations were noted:

The first cervical vertebra was misplaced laterally to the right.

The fourth cervical vertebra was misplaced laterally to the right.

The sixth cervical vertebra was misplaced laterally to the right.

The third thoracic vertebra was rotated on its axis toward the left.

The eighth thoracic vertebra was rotated on its axis toward the left.

The ninth thoracic vertebra was rotated on its axis toward the right.

The tenth thoracic vertebra was misplaced downward anteriorly.

The first lumbar vertebra was rotated on its axis toward the right.

The fourth lumbar vertebra was misplaced downward anteriorly.

The following are the designations of the subluxations of the vertebrae as outlined above:

1C	R. L.	9D	R. P.
4C	R. L.	10D	A. I.
6C	R. L.	1L	R. P.
3D	L. P.	4L	A. I.
8D	L. P.		

Fig. 1 shows these various subluxations marked opposite the vertebrae above enumerated. The marks correspond to the position of the spinous processes of the vertebrae which were subluxated. Several other spinous processes were also found out of alignment, but palpation of the corresponding transverse processes revealed nothing abnormal as to the position of the vertebrae in question. This was later verified upon directly viewing the vertebrae, when it was noted that the spinous processes merely deviated from their normal direction of projection from the body of the vertebrae.

Fig. 5

Fig. 2 shows the back with the skin and superficial fascia removed, and the first layer of muscles of the back revealed. In this illustration the position of the spinous processes is somewhat evident on inspection, and they were readily palpable.

Fig. 3 shows the back with the first layer of muscles removed and the second layer revealed. The spinous processes in this figure are readily seen, and deviations from their normal position can be noted.

Fig. 4 shows the back with the second layer of muscles removed, and the third layer revealed. In this illustration the transverse processes are also seen in some segments, while the spinous processes are very evident.

Fig. 5 shows the back with the fourth layer of muscles removed and the fifth layer exposed. The spinous and transverse processes can be readily seen.

Fig. 6 shows the back with the fourth layer of muscles removed and the fifth layer exposed. The spinous processes in this illustration are entirely uncovered by muscles and ligaments and stand out very prominently.

Fig. 7 shows the left half of the back, the right half having been entirely removed by disarticulating the ribs from the vertebrae, for the purpose of showing the intervertebral foramina seen in the following figure. This illustrates a posterior view of the back, with all muscles and ligaments removed, and showing the vertebrae. The lower ribs have been disarticulated, and the pleura is visible. This figure shows very clearly the misplacement of the eighth thoracic vertebra; note the prominence of the transverse process on the right side; the right side of the intervertebral cartilage was also compressed, and the vertebra misplaced upward, as shown by the fact that the transverse processes of the eighth and ninth vertebrae are close to each other. The upward misplacement is well shown in the following figure.

Fig. 8 shows two intervertebral foramina which are much diminished in size, as will be readily noted by comparing them with the other foramina shown. These foramina whose lumen is diminished correspond to the eighth, ninth and tenth thoracic segments. The eighth thoracic

Fig. 6

vertebra is distinctly shown misplaced toward the right side, which was the side of the spine photographed. Note how the articular process encroaches upon the lumen of the intervertebral foramen. This figure shows the actual narrowing of an intervertebral foramen, by the misplacement of a vertebra, and positively dispels any doubt as to the possibility of vertebral subluxations without fracture, and a consequent narrowing of the corresponding intervertebral foramen. This narrowing is amply sufficient to produce enough pressure upon the vessels transmitted through the foramen, and of the nerves to destroy their power of conductivity.

The following extracts from Dr. Alfred Walton's writings along this subject apply in this connection as bearing on the anatomical basis of chiropractic: "Every normal spine has certain architectural defects. The third and fourth cervical vertebrae are exceedingly delicate in structure, and permit of much lateral motion, whereby the head is greatly tilted to one side, as is seen in children with hydrocephalus. The sixth, seventh and eighth dorsal vertebrae are relatively weak, and are frequently subluxated, which accounts for the prevalence of dyspepsia, and also for the whole train of disorders incident to pressure upon the spinal nerves concerned with digestion.

"The American people are said to be a nation of dyspeptics. The cause is frequently referred to as due to improperly cooked foods and hurried eating; these are not the principal factors, however, for dyspepsia is exceedingly common with those who are confirmed invalids, who eat slowly, and confine themselves to a carefully selected diet. The fact is, that as soon as pressure is removed from the middle dorsal nerves, the dyspeptic begins to take on flesh, and has a digestion strong enough to eat anything placed before him.

"The tenth dorsal vertebra because of not being supported by the ribs, permits of the rotation of the body, a beautiful example of which is demonstrated when the golf player tops a ball. If his drive has been of sufficient force, it will be noticed that the body has described nearly three-fourths of a circle; hence the frequency with which the tenth dorsal vertebra is found out of alignment. Its posi-

Fig. 7

tion is an important factor in the functioning of the kidneys; an adjustment of the tenth dorsal is followed by the disappearance of a great variety of diseases, not only diseases of the kidneys, but those of a totally dissimilar character, but dependent upon uric acid conditions as, for example, rheumatism, neuralgia, eye troubles, and many more forms of skin disease."

The third reason that subluxations are not considered possible by some investigators is, that they have, in the first place, not looked into this subject thoroughly enough, and, secondly, that they have failed to discriminate between the terms subluxation and dislocation, which are entirely dissimilar.

It is true that major lesions of the spine have received proper attention. But the possibility of the existence of minor injuries of the spine has never been thoroughly investigated until the results achieved by spinal adjustment have made it plain that minor spinal lesions are exceedingly common, and are followed by the most serious consequences in many instances. It will be shown further on in this work that upon a proper functioning of the nervous system depends the harmonious relationship of all parts of the body, as well as their functional activity and organic integrity. This being true, the vertebral column becomes the most important division of the body. Yet it has received less study than any other portion, at least from a mechanical viewpoint, and the body should be studied from that viewpoint, since it is in reality a piece of mechanism. The location at which interference with nerve function is most likely to occur is naturally there where the nerves are most subject to injury. Such a location the intervertebral foramina admirably furnish, for here the nerves pass between movable bones which may become misplaced and subject the contents of the foramen to pressure.

Ordinarily when the word subluxation is mentioned the reader at once pictures to himself a disarticulation of the vertebrae, and since it really is impossible for a complete disarticulation of the vertebra to occur without fracture, he discredits the possibility of a subluxation. This is however, the wrong construction of the term since a subluxa-

Fig. 8

tion is not a complete disarticulation of a vertebra from the vertebra above and below it. It is simply a slight change in the relative position of a vertebra with the contiguous vertebrae above and below it. That is to say, instead of the entire surface area of a vertebra being approximated, with die-like precision and accuracy, to its fellows above and below it, it is slightly moved from this position. There is not an absolute and entire separation of the articular processes of two vertebrae; on the contrary, the greater portion of their surface area still oppose each other; there has simply been a slight shifting of one upon the other. This movement takes place in various directions depending upon the configuration of the articular processes.

As was shown in the preceding chapter this movement of a vertebra need be very slight to produce sufficient pressure upon the structures passing through the intervertebral foramen to destroy their irritability and power of conductivity.

The accompanying illustrations show clearly that misplacements of vertebrae may exist without fracture of the vertebrae taking place. Were the vertebrae absolutely locked in position, even the slightest mobility would be impossible, including the normal movements. But the fact that some movement between individual vertebrae is possible is evidence that varying degrees of movement may take place, depending upon the force applied. Anything that is capable of some movement is capable of greater or less movement, and we know that the vertebrae must move upon each other, or there could be no movement of the spine as a whole. When this movement exceeds certain definite limits, there is present the danger of inability of the vertebra to return to its normal position. In speaking of movement in this regard very slight movement is implied, since, as mentioned above, a movement of one-eighth of an inch will occasion pressure upon the structures passing through the intervertebral foramen sufficient to prevent the conduction of impulses to the parts for which they are destined, with derangement in the parts supplied by the involved nerves.

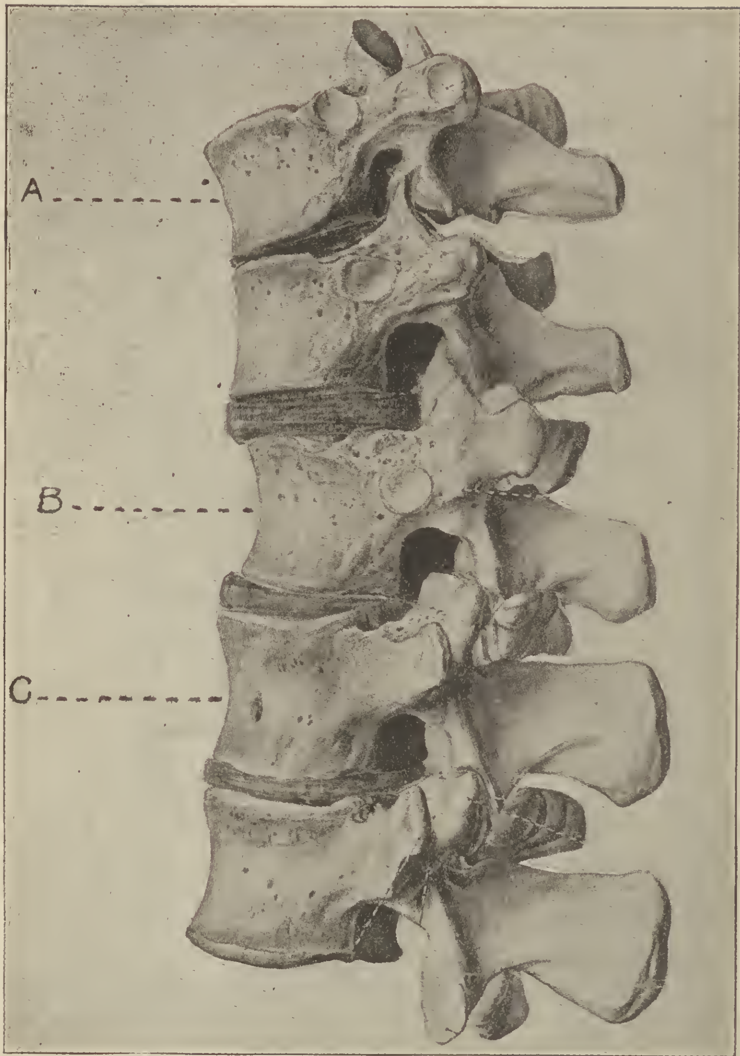

Fig. 9

(A) Compression of the anterior portion of the disc, causing the superior vertebra to approach the inferior, the articular process of which encroaches on the lateral foramen between them.

(B) Posterior thinning of the disc, causing the articular process of the vertebrae below to encroach on the intervertebral foramen.

(C) Compression of the disc in its entirety, resulting in a diminution of the vertical diameter of the intervertebral foramen.

CHAPTER IV

The Physiological Basis of Chiropractic

In the preceding chapter it was shown that subluxations of the vertebrae can and do occur, and that as a result of this misplacement sufficient pressure is brought to bear upon the structures passing through the intervertebral foramina, by the misplaced margins of the foramina, to seriously impair their function. In this chapter we will consider the manner in which this disturbance of the functional activity is brought about.

The Function of the Nervous System.—By virtue of its continuity the nervous system puts into connection all the other systems of the body. Its branches form pathways over which nerve-impulses pass from the brain and cord to every part of the body, and from the periphery to the brain and cord. All incoming impulses must react in the central nervous system. It is a fact of the utmost importance that until the incoming impulses have reached the brain and spinal cord, outgoing impulses are not generated. It must be remembered that nearly all outgoing impulses are generated as a result of stimulation of the cerebral or spinal centres by an incoming impulse. For example, the sight of food excites an afferent impulse to the brain which in turn excites an efferent impulse in the cerebral centres which send nerve-fibres to the salivary glands and stomach and a flow of saliva and gastric juice results. In like manner every action performed by any part of the body is produced as a result of an outgoing impulse which was generated in the brain or spinal cord in response to an impulse from the periphery.

By means of the central nervous system reactions are established in parts of the body not directly affected by changing external conditions. In this way harmony between the activities of the various systems of the body is maintained. Also the body as a whole, in relation to all things outside it and forming its environment, is under the guidance of the nervous system.

The Conduction Process.—In order to appreciate properly the effects of pressure upon the nerve we must first look into the nature of the transmission of impulses along the nerves, namely, the conduction process. Many views have been advanced as to the nature of the conduction process, among which are the following: that the whole nerve moves like a bellrope; that the nerve is a tube and a biting acid flows through it; that the nerve contains a fluid which moves in waves; that it conducts an electric current like a wire; that it is composed of definitely arranged electro-motor molecules which exert an electro-dynamic influence on each other; that it is made up of chemical particles each of which excites its neighbor; that the molecules of the nerve-substance undergo a form of vibration like that of light.

None of these theories has been proven as the only correct one, and it is likely that the conduction process is simply a property of the living substance of the cell. It is a state of activity which spreads like a wave in all directions through the living substance. It is markedly changed by chemical and physical influences. Protoplasmic continuity is absolutely essential to conduction. Hence, as will be shown further on, any pressure upon the nerve which breaks this protoplasmic continuity impedes the transmission of impulses along that nerve.

The Nerve-impulse.—The neurones form pathways along which nerve-impulses travel. It is through the power of conductivity possessed by the neurones that the impulses travel along the nerves. The impulses which arrive at the cell-body produce there chemical changes. These changes, when they reach a given volume, cause a nerve-impulse which leaves the cell-body by way of the axone.

As will be pointed out, the impulses travel either toward the central system, or from it. The former class of impulses are called afferent, and by means of them the proper relationship of all parts of the body, individually and collectively, to their environment is maintained. The latter class of impulses are known as efferent, and it is through them that the functional activity and organic integrity of every part of the body are governed and maintained.

The amount of nerve influence generated by the brain

must always be commensurate with the amount of work required of the parts supplied by the nerves. This is excellently illustrated by the following: We have the power of determining beforehand the amount of nervous influence necessary for the production of a certain degree of movement. Thus, when we lift a vessel, the force which we employ in lifting it depends upon the idea which we have formed of its contents, when we are not certain what it contains. If it should contain something much lighter than we had estimated, useless force would be expended, and it would be lifted with exceptional ease; but if it contain something much heavier than we had anticipated, we would very likely drop it, because insufficient force was expended to accomplish the end desired.

Just as the response of muscles is proportionate to the amount of nerve-force received by them, so also are the functional activities of all parts of the body dependent on the amount or strength of the nerve-impulses received by them. If, therefore, anything interferes with the power of conduction of the nerve, the impulses which it normally conveys to the parts which it supplies are not forthcoming, and these parts will suffer. There will be either functional derangement, or changes in its structure.

Irritability of Nerves.—Irritability is that property of living protoplasm which causes it to undergo characteristic physical and chemical changes when subjected to certain influences, called irritants. The term irritants, when speaking of nerves, includes anything which causes the nerve-cell to send an impulse along its branches. The irritability of cell-protoplasm is very dependent upon its physical and chemical constitution and even slight alterations of this constitution, such as may be induced by mechanical conditions, may modify the finely-adjusted molecular structure upon which the normal response to irritants depends.

Without going into this subject in detail, the fact must be stated that, when a nerve is experimentally subjected to slight pressure, it is found that it will not conduct impulses; when the pressure is removed, it again conducts the impulses. A frog in which the sciatic nerve and gastrocnemius muscle are dissected and prepared, and then connected with

an electric current, will show this. When the nerve is stimulated by the current, contractions of the muscle occur; when pressure is brought to bear upon the nerve, the muscular contractions cease; when the pressure is removed and the nerve again electrically excited, the contractions of the muscle again occur. This proves conclusively that the pressure which was applied prevented the conduction of the impulses, for it is the nervous impulses that caused the muscle to contract. It also shows and demonstrates another important fact, namely, that sufficient pressure may be applied to a nerve to prevent it from conducting impulses without destroying the nerve itself, because, in the experiments mentioned, as soon as the pressure was removed, the muscular contractions again occurred.

The Effect of Pressure upon a Nerve.—In a future chapter the effects of vertebral subluxations are given in detail, but the physiological effect of pressure on nerves in general must be considered in this place.

The effect of pressure to lessen the conduction power of nerves is one which everyone may demonstrate upon himself. For example, if pressure be brought to bear on the ulnar nerve where it crosses the elbow, the region supplied by the nerve becomes numb, "goes to sleep," as it were.

In like manner, mechanical applications to nerves first increase and later destroy their irritability. Thus pressure gradually applied first increases and later reduces the power to respond to irritants.

As stated above, sufficient pressure may be applied to a nerve to destroy its irritability and conductivity without injuring the nerve itself structurally. Such pressure is exercised upon the nerves passing through the intervertebral foramina by the misplaced margins of the foramen when a vertebra is subluxated. The pressure does not crush or otherwise injure the nerve, but it is sufficient to block the impulses which pass along that nerve. As a result, the organs which are deprived of these impulses undergo functional or organic aberrations, and disease results in the part supplied. The nature of the disease depends upon other contributing factors which may be present at the time of the subluxation, or may appear later. In any event the subluxa-

tion, by promoting conditions in the organ which make disease possible in that organ, are the primary cause of that disease.

For example, a subluxation is produced in the lower dorsal or upper lumbar region of the vertebral column; no untoward effects may follow at once. But years later, perhaps, the individual develops typhoid fever. The reason that this occurs is simply that the intestines which are the atrium of the infection in this disease are in such a state of diminished resistance that they form a favorable culture-medium for the multiplication of the typhoid bacilli and the elaboration of their toxins. It is for this reason that the fever subsides so rapidly when these subluxations are corrected—because the elaboration of the toxins, which are the cause of the fever, is arrested, favorable conditions for the activity of the bacilli having been eliminated.

The Effect of Blood-supply on Nerves.—In addition to the direct effect of pressure upon the nerves, owing to a subluxation, there is also an indirect effect, as a result of the occlusion of the blood-vessels which pass through the intervertebral foramen.

The nerve-fibre requires a constant supply of blood for the maintenance of its irritability. The irritability of the nerve cannot long continue without oxygen, and a nerve which has been removed from the body is found to remain irritable longer in oxygen than in air, and in air than in an atmosphere which contains no oxygen.

It will be learned further on that one of the effects of a subluxation is pressure upon the arteries and veins. These arteries supply the structures of the corresponding segment of the spine with nourishment, and the veins carry away the waste materials. When the circulation of the blood is impeded, there will consequently be an impoverishment of the nerves, and an accumulation of waste materials, both of which have a deleterious effect on the nerves.

Another function of the blood in respect to the nerves is that it distributes heat. A nerve which is deprived of this heat loses its power of irritability and conductivity. This can be demonstrated by dipping the elbow in ice-water, and allowing it to remain there until the cold has had time to

penetrate; at first there will be pain, but as the effect of the cold becomes greater, the pain is replaced by numbness, both the irritability and power of conduction of the nerve being reduced.

In like manner obstruction of the arteries passing through the intervertebral foramina, by pressure upon them of the misplaced margins of the foramen, diminish the blood-supply to the nerves, and hence the heat which the blood normally conveys to them. Impulses to be transmitted by that nerve will accordingly be impeded, or fail to reach their destination, and disorders in the parts thus deprived of their necessary nerve-force will follow.

Further, the blood has the power to neutralize the acids which are produced by the cells during action, and so maintain the alkalinity essential to the life and activity of the cell; also, by virtue of the salts which it contains it secures the osmotic relations which are necessary to the preservation of the normal chemical constitution of the protoplasm of the nerve.

The irritability of nerve protoplasm is markedly influenced by even slight changes in its constitution. If, experimentally, a nerve be allowed to lie in a liquid of a different composition from its own fluid, and especially if such a liquid be injected into its blood-vessels, an interchange of materials takes place which results in an alteration of the tissue and a change of its irritability.

If, therefore, the venous flow is obstructed, the acid waste materials of the activities of nerves remain within them, and a change in the constitution of their protoplasm impairs their irritability and conductivity. This effect the pressure of the misplaced margins of an intervertebral foramen produces by obstructing the circulation of the blood in the veins which it transmits.

The Effects of Lymphatics on Nerves.—The last of the physiological effects resulting from a subluxation of a vertebra with consequent narrowing of the corresponding intervertebral foramen is the influence which it exercises upon the lymphatics, and their effect on the nerves which they supply.

The lymphatics which pass through the intervertebral

foramina have much to do with the metabolism of each segment of the spinal cord. If the nutrition of a certain segment is faulty as a result of an insufficient supply of lymph, the reflex excitability of that segment will be diminished. Consequently any incoming impulses to that segment will not result in a reflex action with the production of an outgoing impulse, and the tissues thus deprived of these necessary impulses will fail to function properly. When we consider that most of the vital functions are regulated by reactions in the brain and spinal cord, the part played by a subluxation in interfering with the nutrition of the central nervous system takes on an added significance.

Such a condition of hypo-excitability is always produced by a vertebral subluxation. In such an event the lymphatic flow is obstructed, and the corresponding segment of the spinal cord and the spinal nerves emerging through the narrowed intervertebral foramen is improperly nourished, and diminution of its irritability and power of conductivity results.

From the foregoing it is apparent that the effects on nerve function attributed to vertebral subluxations are in perfect accord with accepted physiological facts and must therefore be considered as scientifically correct. To recapitulate: Nerve impulses travel along a nerve and all its branches and control the functional activity and organic integrity of the parts in which they end. Pressure upon these nerves will prevent the conduction of these impulses to the parts for which they are destined, without necessarily injuring the nerve itself. Vertebral subluxations are capable of producing such a pressure on the nerves emerging through the intervertebral foramina. Removal of this pressure by correcting the subluxation will again permit the nerve to conduct impulses to the parts for which they are intended, and thus restore them to their normal condition.

CHAPTER V

The Physical Basis of Chiropractic

The human spinal column presents certain physical features whose study reveals many facts that confirm the truth of the principles on which Chiropractic is founded.

As previously stated, the basic principle of chiropractic is that vertebrae may become subluxated and that in consequence thereof disease results. If it is true that subluxations of vertebrae are a cause of disease in a large proportion of cases, it follows that subluxations must be of common occurrence.

It is a fact, easy of demonstration, that there is no one whose spinal column will not reveal one or more subluxated vertebrae. And there are a number of physical reasons to account for this condition.

First and foremost among these reasons is the architecture of the spine itself, or more correctly speaking, the nonconformity of its architecture to the purpose which it serves. The spine is used as a column, while it is really designed to serve as a beam. A study of the spine from a strictly mechanical standpoint will show that this is true. When a spinal column is suspended horizontally all the vertebrae lock with one another, the zygapophyses being in perfect articulation and resting *upon* each other. When the spinal column is held vertically the vertebrae tend to collapse upon one another, the zygapophyses are loosely articulated and rest *against* each other. Viewing the spine in these respective positions shows at a glance that it is not architecturally adapted to use as a column, but is designed to serve as a beam.

During two-thirds of the average individual's lifetime he is in the upright posture using the spine as a column. And, inasmuch as in this position the articular processes set against rather than upon each other and are insecurely placed and imperfectly held in apposition by the ligaments surrounding them, it follows that misplacement of the ver-

tebrae is rendered extremely likely. That this explains in large part the prevalence of misplacement of vertebrae there can be no question. Were the spine used in the manner which its architecture indicates as its proper use, subluxations would be as infrequent in man as they are in the lower animals. Moreover it can readily be demonstrated on a dry spine how easy it is to partially disarticulate any vertebrae when the spine is held vertically as compared with the difficulty experienced in doing so when the spine is suspended horizontally. It is, therefore, correct to assume that subluxation of vertebrae must be a common occurrence for this reason if for no other. But there are still other physical reasons for the frequency of vertebrae subluxations.

The loading on the column is eccentric, the center of gravity of the head and thorax being outside the center line of the column. This means the vertical column always has a load on it tending to pull it downward. To compensate for this eccentric load it has to support, the column assumes a secondary curve in the lumbar region which compensates for the curve in the thoracic region, and enables the individual to stand in the upright position. These curves due to deflection are parabolic. That this secondary curve is entirely artificial is shown by the fact that at birth an infant has no lumbar curve and does not develop such a curve until he assumes the upright posture in walking. The forward pull on the upper portion of the spine, and the forward curving of its lower portion disposes the vertebrae to the various forms of misplacement which are characteristic of these respective regions and which are capable of demonstration in practically every human spine that is examined.

It has been a matter of common observation that some vertebrae are more commonly subluxated than others. This is likewise explainable on a physical hypothesis, which in turn substantiates one of the basic principles on which Chiropractic rests. It is clinically noted that the atlas, fourth cervical, second, fifth and tenth dorsal, second and fifth lumbar vertebrae are found subluxated more frequently than any other vertebrae. There are two physical reasons

for this: first, the structure of the vertebrae; second, their position in the column.

The atlas, being the first vertebra in the column bears the direct weight of the head and undergoes the greatest strain in both the forward and backward as well as the rotatory movements of the head. The fourth cervical vertebra is structurally one of the weakest in the column and is the central point of rotation, flexion and extension of the neck. The second dorsal vertebra bears the greatest stress in flexion of the neck and the upper portion of the thoracic spine; the disc upon which it rests is thinned anteriorly and stretched posteriorly during such a great part of the time by most persons in connection with their work that it ultimately becomes permanently wedge-shaped being thinner anteriorly than posteriorly, causing this vertebra to be tilted antero-posteriorly. The fifth dorsal vertebra bears the greatest stress in anterior and lateral flexion of the dorsal spine. The tenth dorsal vertebra lacks the strength and support of most other dorsal vertebra, and the full effect of rotation of the spine is expressed at this point, with the result that it is frequently found rotated, e.g., golfers. The second lumbar vertebra is situated at the point of greatest tension in the compensatory lumbar curve of the spine, and bears the full force of all extension and flexion movements of this section of the column. The fifth lumbar vertebra is the last movable vertebra of the column and receives the full effect of all loads carried by and all stresses applied to the column in the vertical plane; it is thinner posteriorly than anteriorly and is very insecurely articulated with the sacrum when the spine is held vertically.

The nature of misplacement of these vertebrae being analogous to their normal movement and the prevalence of disorders of organs which are known to derive their nerve-supply from corresponding segments of the cerebrospinal or autonomic systems, both prove clearly the reason why they are most frequently subluxated and that there is an undoubted connection between their misplacement and diseases of certain organs.

It is a common observation that the atlas is usually

rotated posteriorly on the left side in right-handed persons and in the opposite direction in left-handed persons. There is a two-fold reason for this: we invariably incline the head toward the right side causing forward movement of the atlas on that side; this rotation causes a certain amount of distortion of ligaments which eventually deflects the atlas permanently in this direction. This has its counterpart in various positions of the body, viz., the slight lateral curve of the spine in all persons, elevation of the right shoulder and hip, etc. This misplacement of the atlas explains the many disorders of vaso-motor and cranial nerve functions which are explicable in no other way.

The fourth cervical is usually found rotated accompanied by a lateral tilting, which misplacement is nothing more nor less than an exaggeration of the normal movement which it undergoes in rotation and lateral flexion of the neck. The relationship of subluxation of this vertebra to disorders of the head, neck and thorax is thus made indubitably clear.

The antero-posterior tilting to which the second dorsal vertebra is subjected in connection with nearly all occupations results eventually in a permanent distortion of the disc attached to its under surface, making it wedge-shaped with the apex of the wedge anteriorly. This results in a corresponding change in the position of this vertebra, creating what is known as an antero-inferior subluxation. If this tilting is extreme and the stresses producing it are excessive the body of the vertebra may itself become wedge-shaped, making complete realignment impossible. This is the usual reason for failure to obtain a complete adjustment of any vertebra. A review of the disorders incident to the assumption of a position which sharply flexes the upper dorsal spine will show the connection between them and subluxation of the second dorsal vertebra.

Flexion of the mid-dorsal spine expresses itself most actively on the fifth dorsal vertebra and is responsible for the frequency of subluxation of this vertebra which is usually found misplaced in the same way that is the second dorsal. Lateral movements of the spine likewise bring special strain to bear on the fifth dorsal causing it to be

tilted sidewise and at the same time rotated. The usual misplacement noted is a tilting and forward rotation on the right side, creating a combination of a right inferior and left posterior subluxation. The prevalence of gastric disorders offers the greatest proof in support of not only the bearing which subluxation of the fifth dorsal vertebra has on the production of these disorders, but also the corresponding frequency of this cause and effect.

Rotation of the spine expresses itself most forcibly on the tenth dorsal vertebra. In practically all rotatory movements of the spine the vertebrae are rotated forward on the right side in right-hand persons and *vice versa* in left-handed people. Accordingly we find the tenth dorsal rotated forward on the right side, creating a left posterior subluxation. And, since the ligaments attached to the right side of the vertebra are contracted its rotation is usually accompanied by a downward tilting on the same side. Here, again, we see the connection existing between the most common subluxations and the most prevalent diseases. The tenth dorsal vertebra is found subluxated in practically all cases of kidney disease. The prevalence of diseases of the kidneys and the frequency of subluxation of the tenth dorsal vertebra must have some relation to each other in view of their almost invariable coincidence. That subluxation of this vertebra actually does operate as a cause of kidney disease is proven by the fact that albuminuria can be produced in a few minutes by assuming a posture which places this region of the spine in a lordotic position.

The compensatory curve in the lumbar spine previously referred to is expressed with the greatest force on the second lumbar vertebra, resulting in an antero-posterior tilting of this vertebra because of the anterior thinning of its subjacent disc. Thus, an antero-inferior subluxation (*posterior:* spinous process nomenclature) is created. The arc of rotation of the lumbar spine likewise has its centre at the second lumbar vertebra, and since the spine is rotated forward on the right side this vertebra will frequently be found rotated similarly when its normal range of motion is exceeded. This accounts for the great frequency of left posterior subluxations of the second lumbar vertebra. Here

again we see the analogy between subluxation and disease prevalency. The second lumbar vertebra is virtually always found subluxated in constipation, showing the relationship between its frequency and this exceedingly common disorder.

The fifth lumbar vertebra is usually found tilted anteroposteriorly with the inferiority at its posterior aspect. The reason for this is three-fold. The fifth lumbar receives the full effect of all forces applied to the column; it is imperfectly articulated with the sacrum; its centrum is thinner posteriorly than anteriorly. Obviously all these factors combined favor a downward movement of the back portion of this vertebra resulting in a postero-inferior subluxation.

It may be well, at this point, to say something regarding the terminology of the subluxations enumerated above. The terminology used in this work is based upon changes in the position of the body of the vertebra. The *body* is the axis of all normal movements of the vertebra. Hence any change in the position of the vertebra should be expressed in terms of changes in the position of the body—*centrum*—rather than on changes in the position of the processes of the vertebra. Moreover, a nomenclature based on changes in the position of the spinous process of a vertebra is very apt to be misleading. For example: when a vertebra is tilted downward anteriorly the spinous process is carried upward and backward. A nomenclature based on the change in the position of this spinous process refers to this form of subluxation as a *posterior*. This gives the impression that the vertebra is misplaced posteriorly, which is incorrect. It would accordingly be more correct to use the term *antero-inferior*, which indicates that the front part of the body of the vertebra is tilted downward, and more accurately denotes the exact change in the position of the vertebra. The same principles apply to several other forms of subluxation, as will be noted in the chapter dealing with the various subluxations.

Any subluxation of a vertebra is nothing more nor less than an exaggeration of its normal movements. The reason that the vertebra is subluxated lies in the fact that its normal range of mobility has been exceeded. When this

takes place the ligaments attached to one side of the vertebra are stretched beyond their limit of elasticity, and on removal of the force which caused the vertebra to exceed its normal range of mobility, these ligaments do not return to their former position but remain set. The ligaments on the opposite side become proportionately contracted. As a result, the vertebra when once moved into this position is fixedly held therein by the state of the ligaments. The discs attached to the vertebra likewise undergo a certain amount of distortion which persists if the elastic limit of any of their fibres has been exceeded by the tension to which they have been subjected in connection with the excessive movement of the vertebra. This explains why a number of adjustments must be made before a vertebra is completely realigned. In dealing with a vertebra the adjuster does not deal with only articulating bones, as for example in reduction of a dislocated shoulder, but also with ligaments. True, the vertebra is completely returned to its normal position during the time that the force of the thrust is applied to it; but it returns most of the distance toward its former abnormal position as soon as this force is removed, because of the distortion of the discs and ligaments. Repeated adjustments are, therefore, required for the purpose of equalizing the length of the ligaments and the conformation of the discs. All subluxations are induced gradually, years being sometimes required for their full development. Hence it is logical to presume that some time will be required to restore the involved ligaments and discs to their normal condition.

In all subluxations, however produced, contraction of the ligaments and discs takes place. This contraction does not, however, persist indefinitely. In all cases there is a reaction of inflammation with subsequent organization of the inflammatory products, creating microscopic adhesions between the fibres of the ligaments and discs. These adhesions bring about a *contractured* condition of the ligaments and discs, so that even after the cause has been removed the condition of the discs and ligaments remains as before and the altered position of the vertebra likewise persists.

The essential feature of a subluxation is that the ver-

tebra is fixed in its abnormal position and no longer takes part in the normal movements of the spine as a whole, or of that section of the spine of which it is a part. So long, therefore, as a vertebra possesses its normal mobility it cannot be considered as subluxated. Partial immobility implies movement of the vertebra beyond its normal range of motion, namely, in a position where it is no longer in normal approximation with the vertebra above and below. A vertebra may be apparently out of its normal position but so long as it takes part in the normal movement of the spine it cannot produce any harmful effect. That this is true is shown by the presence of rigidity in all abnormal states of the organism, whether local or systemic. All systemic affections are accompanied by general spinal rigidity; all local affections are accompanied by rigidity in that segment from which the affected part derives its innervation. As we shall see further on, the cure of disease by adjustment of subluxated vertebra is in part accompanied by the conversion of rigid segments into movable units. Rigidity of the spine moreover has its counterpart in all portions of the body. It is the first reaction of any living part to irritation of whatever kind. Hence, the irritation that occurs in connection with a subluxation is evidenced by rigidity, and it is this rigidity which constitutes the essential feature of a subluxation.

It is necessary that a clear distinction be made between a luxation and a subluxation of a vertebra. A subluxation is not a disarticulation of a vertebra from the adjacent vertebrae above and below it, but simply a slight change in the relative position of one vertebra to the contiguous surfaces of the vertebra with which it articulates. In other words, instead of the entire surface area of a vertebra being approximated to its fellows above and below, it is slightly moved from this position. There is not an absolute and entire separation of the articular processes or bodies of two vertebrae. The greater part of their surface area remains in opposition.

Inasmuch as the wall of the intervertebral foramen is made up of the opposing parts of two vertebrae it follows that a shifting of one of these vertebrae will alter the area

and dimensions of the foramen. Since each vertebra contributes to the wall of two foramina—one above, the other below—it is evident that one of these foramina will be reduced in size when the vertebra is moved from its normal position. The nature of the misplacement determines which of the foramina will be affected in this way. Since the foramina are only of sufficient size to properly accommodate the structures which they transmit, it is evident that narrowing of the foramen by movement of any of its boundaries toward its centre will cause the misplaced boundaries to encroach on the contents of the foramen. The intervertebral foramen of the adult human spine averages approximately one-fourth inch in diameter and its contents average about one-sixth inch in diameter. The structures within the foramen are placed in such a position that they do not come into actual contact with its wall at any point. But their farthest distance from the wall of the foramen is only one-eighth of an inch, while their nearest distance from the wall of the foramen is about 1/32 of an inch. It is apparent, therefore, that very slight movement of the vertebra is required to encroach upon the structures which the foramen transmits.

Impingement upon the sheath of the structures transmitted by the foramen does not pinch the structures in the sense that stepping upon a hose, for example, would imply. The impingement on the other hand causes an irritation which results in a reaction of inflammation. The products of the inflammation become organized and the added tissue encroaches upon the space required by the structures contained within the sheath. The sheath itself becomes thickened, as do all tissues when subjected to irritation, and as a result, there is an impingement of all the structures which it contains. All these structures are equally involved, so that it is incorrect to assume that one fibre of the spinal or autonomic nerve is impinged and other fibres escape this impingement. All the structures within the sheath are equally involved and the effect at the periphery is a composite of the results of impingement of these several structures.

The effect at the periphery (all parts of the organism

outside the central axis) expresses itself in functional or organic derangement of the part which derives its innervation from the segment in relation to the subluxated vertebra. This effect is due not only to the fact that the impulses generated in the central axis are blocked by the subluxated vertebra. It must be borne in mind that not only are nerves impinged when the intervertebral foramen is narrowed but the vessels are also impinged. These vessels supply each corresponding segment of the spinal cord and give it that irritability which causes it to respond to stimuli from the periphery. These stimuli call for a certain amount of nerve force, which is generated in the central axis, and directed to the part from which the stimulus was received. If the irritability of the segment in which the stimulus is received is below par, the reaction, which results in the generation of nerve force, does not take place in normal volume or rapidity. Hence, even though the nerve pathways, both incoming and outgoing, were entirely free, the part to which they lead would be deprived of a certain quota of its innervation because insufficient nerve force was being generated in the central axis.

Each cell terminal of an incoming nerve fibre possesses tendrils which arborize about the cell from which the outgoing nerve fibre arises. These tendrils establish a contact between the two cells in such a way that incoming stimuli "charge" the cell of the outgoing nerve. When this charge has attained a given volume there is a discharge of nerve force. This implies that the nerve cells are virtually the same as a battery, which is entirely true. They consist partly of acid and partly of alkaline material and contain a given amount of oxygen. Furthermore, the entire arrangement is in such absolute accord with the construction of the simplest or most complex electrical devices that it is correct to assume that nerve force is a *force* whose generation and transmission is accomplished in a manner practically identical to that of electricity.

The nerve force generated in this manner brings about a reaction in the part to which it is directed. The nature of this reaction will depend entirely upon the construction of the part. If it is a gland cell secretion begins; if it is a

muscle cell, contraction follows. Each part must receive a certain amount of nerve force for the normal performance of its function. It will function only in proportion to the amount which it receives. Hence, when it is deprived of a certain amount of nerve force its functional activity is proportionately reduced, creating disharmony in the organism. This manifests itself in various ways, depending upon the function that has been impaired or abrogated.

From the foregoing, it is apparent that the principles of Chiropractic are in absolute accord with all physical truths. Moreover, the science of physics offers a large number of facts in substantiation of the correctness of the underlying principles of Chiropractic. Additional evidences of this will be found in future chapters of this work.

CHAPTER VI

The Clinical Basis of Chiropractic

Having demonstrated that subluxation of vertebrae is a causative factor in most diseases and that the adjustment of such subluxated vertebrae effects a cure in the majority of cases, it next becomes necessary to consider the exact manner in which subluxated vertebrae cause disease and their adjustment cures disease.

How Subluxations Cause Disease

To say that subluxation of a vertebra is the one and only cause of disease is incorrect. We are constantly surrounded by harmful influences of various kinds connected with our environment. The mere fact that the most important purpose of the nervous system is to keep us in proper relationship to our environment shows that it must possess harmful influences and that there exist about us various factors characterized to produce different disorders in the organism. Hence it must be assumed that, although subluxations are demonstrable in practically all disorders, other causative factors are frequently combined with them to induce such disorders. The variety of disorders of any organ in itself disproves the claim that subluxations are the one and only cause of disease. Consider for example the stomach: This organ may be affected in many ways and yet only one subluxation is present in all. There must be other factors connected with the subluxation to determine the nature of the disease process. Obviously, given five persons all possessing the same subluxation, there must be some other factors at play to determine why one has chronic gastritis, another ulcer, another cancer, another hyprechlorhydria, and another dilatation. These diseases are so different in all their manifestations that they are absolute entities, and could not possibly be ascribed to a single cause. In other words, we must admit the existence of other causes of disease than subluxation of vertebrae.

As stated above, it is a fact that in the vast majority

of abnormal states of the organism a subluxation is demonstrable. That this subluxation has an etiologic bearing on the disorder is unquestioned, because we know from a clinical standpoint that its adjustment has a favorable effect on the course of the disease. How the subluxation operates in the production of the disease is readily ascertained by determining in which classification the subluxation falls. All causes of disease readily group themselves into a number of kinds. Accordingly a particular cause may be: (a) **direct** or **indirect**; (b) **predisposing** or **exciting**; (c) **inducing** and **perpetuating**.

Every known cause of disease comes under one of these heads. That is to say, a certain causative factor may be either a direct or indirect cause of a certain disease; it may be a predisposing or exciting cause; or it may be an inducing or a perpetuating cause. A certain factor may be a direct cause in one disease and an indirect cause in another disorder; it may be a predisposing cause in one disease and the exciting cause in still another; it may be the inducing cause in one disease and the perpetuating factor in another. For example: Alcoholism can be the direct cause of acute gastritis, the indirect cause of arteriosclerosis, the predisposing cause of pneumonia, the exciting cause of nephritis, the inducing cause of neuritis, and the perpetuating cause of cardiac neurasthenia. In each condition it operates differently, yet has some influence in the production of the disorder. But it is not a factor in all diseases, nor in every case of the diseases named. There is no etiological factor that is always present in all diseases.

Of all the causes of disease there is one which is more universally present than any other, and that is subluxation of the vertebrae. We believe that in 90 per cent of all abnormal states there is a demonstrable spinal lesion. The presence of such a lesion and the part it plays are explainable under the aforementioned classes of causes.

First, a malposed vertebra may be the **direct** cause of many diseases. Their number includes such common conditions as constipation, lumbago, asthma, neuritis, and rheumatism. In these diseases the abnormal state is induced directly by the withdrawal of innervation from the affected

part by impingement of its nerves at the intervertebral foramen. So specific is the operation of this cause that no other factor is generally required to produce these diseases. That this is true is amply attested by the fact that adjustment of the offending vertebra is of itself sufficient to restore the parts to normal.

Second, a subluxated vertebra is an **indirect** factor in the production of disease which is more universally evident than any other of the causes of disease. It is exceedingly common to find upon investigation into the etiology of a certain malady that back of it all is a subluxated vertebra. There are many cases in which the attendant is at a total loss to account for the existence of the disorder in the subject before him, who had not been exposed to the direct cause of the disease to an extent in any way greater than have his fellows. And yet this particular individual suffers while others equally exposed go free. To the medical man this has always been a perplexing problem for which he has never been able to find a satisfactory explanation. One finds what are perhaps the best illustrations of this in the occupational diseases. Many men may be engaged in the same kind of work under identical working conditions, and yet the deleterious effects of their occupation are visited upon certain ones only. Evidently there must have been some factor at work that rendered these particular individuals susceptible to the bad features surrounding their occupation. Otherwise all would be similarly affected, inasmuch as all are equally exposed. Examples of such occupational diseases are not difficult to find, common instances being such disorders as lead poisoning, writer's cramp, varicose veins, emphysema, and anthrax. To one who has studied the part that subluxated vertebrae play in the production of disease the answer is plain: the individual who contracted a certain disease which left others free did not possess the requisite vital resistance of those organs for which the harmful influences with which his occupation brought him into daily contact had a predilection. His fellows did possess a sufficient amount of this vitality to enable nature to counteract the vicious influences that were attacking living structures. Hence the former became affected, while the latter remained

unscathed. It must be borne in mind that nature's aim is to preserve, and she exerts herself to the utmost to carry out her designs in this regard But she must be left free to carry out her work—she must not be handicapped. And there is nothing which offers a greater obstacle to nature in carrying out her beneficent designs than blocking the channels through which she operates: the neuro-vascular system. It is plain that nature must have the proper instruments necessary to the carrying out of her designs. She is the Great Artisan, and must possess the tools of her trade, if she is to make the repairs which the wear and tear of daily life make necessary. She will be entirely helpless if the nerves that control the affected portion of the body are blocked, as they are when a subluxated vertebra impinges them. And so, subluxation of vertebra may be the indirect cause of a malady, by denying nature the means through which she negatives those directly harmful factors that beset man in his daily pursuits.

Third, a subluxated vertebra may act as a **predisposing** cause in certain diseases. The role which it plays here is in many respects almost identical to its part in those conditions where it is an indirect cause of a disease. The infectious diseases offer us the best examples illustrating the action of a subluxated vertebra as a predisposing factor in the production of disease. We do not deny that there are other elements in predisposing an individual to these diseases, but how often it happens that they are not in evidence in one or another case. But often in conjunction with other predisposing factors we see that a vertebral subluxation has much to do with the inauguration of that state which makes a certain individual subject to the onslaughts of the specific cause of a certain disease. But it is in those instances which fail to reveal any predisposing cause of the disease before us that subluxations assume greatest importance and offer the only reason for the presence of the patient's malady.

Every part of the body is, under normal conditions, maintained at a certain state of condition through the neurovascular system which supplies it with vital properties. So long as it receives the proper amount of this vitalizing influ-

ence its functional activity and organic integrity are at par. It performs its work properly and undergoes no retrogressive changes; it is immune to the attacks of harmful influences that attack it. If, however, such a part is deprived of its normal quota of innervation and vascularization it becomes both functionally and organically deranged, and offers a lessened resistance to any deleterious influences that it encounters. Inasmuch as it is through impingement of the nerves by a subluxated vertebra that a part is deprived of its normal quota of innervation and vascularization it follows that subluxation of the vertebrae is in such an instance the predisposing cause of whatever disease may develop in consequence of the depraved state of that part. It is not necessary that the entire body economy be in a "run-down condition". It is sufficient simply for the part which offers a gateway of entrance for the infection, or whatever may be the exciting or direct cause of the disease in question, to be of lowered vitality to predispose the individual to that particular disease.

Abundant evidence is at hand to show that subluxation of a vertebra operating in the manner outlined can and does act as a predisposing cause of many diseases, and that without it such diseases could not develop. True, the subluxation of the vertebra does not directly cause the infectious disorder, the disease being directly induced by bacteria. The subluxation is, however, the primary and underlying cause for the reason that by it the innervation of the atrium of infection is diminished, and its vital resistance reduced, making the action of bacteria possible. Considerable variance of opinion exists on the germ theory, some writers holding that the bacteria act in the capacity of scavengers. Their presence is explained on the hypothesis that they remove dead tissue which has become necrotic because of denervation of a part. In view of evidence showing the part which bacteria have in the etiology of disease, such a contention is unwarranted. The only correct assumption is that subluxations are the predisposing and bacteria the exciting cause of all infectious diseases.

Fourth, a malaligned vertebra may, by impinging a nerve and thus depriving the part supplied by it of its normal quota

of innervation, be the exciting cause of disease in such a part. One of the best examples illustrating the role of a subluxated vertebra as an exciting cause of disease is constipation, and a brief consideration of the manner in which a subluxated vertebra can induce this condition will explain how various other maladies can be similarly brought about.

The act of defecation like all functional activities is dependent upon two things: a stimulus at the periphery and a response from the center. This requires an unbroken cycle over which the impulses created by the peripheral stimulation and those generated by the central response are to travel. Obviously if the pathway which these impulses traverse is blocked at any point the incoming impulses do not reach the center or the outgoing impulses do not reach the periphery.

Let us trace the defecation reflex, for example. The rectum is supplied by the third and fourth sacral nerves and by branches from the inferior mesenteric and hypogastric plexuses. The first step is stimulation of the nerve-endings in the mucous membrane of the rectum by its contents. The impulses created there are conveyed to the special defecation center in the lumbar enlargement of the spinal cord either by way of the sacral nerves, or through the autonomic plexuses, the gangliated cord, and the rami communicantes to the lumbar nerves, through the posterior roots of which they reach the defecation centre in the cord. Here they are transferred to the cells of origin of the outgoing nerves, where they become converted into outgoing impulses which pursue two courses: first, they descend through the third and fourth sacral nerves and inhibit the circular fibres and contract the longitudinal fibres of the musculature of the rectum. Secondly, this action is immediately followed by impulses which traverse the autonomic course, through the anterior roots of the lumbar nerves, the rami communicantes, the gangliated cord, and the inferior mesenteric plexuses branches of which terminate in the rectum. These latter impulses produce in rapid succession from above downward contraction of the circular muscle fibres of the rectum. The two series of impulses thus first open a way for the

passage of the fecal matter and then force it through this opening.

It is apparent that no movement of the muscular fibres of the rectum will occur unless they are stimulated in the manner indicated. And if they are not thus stimulated the contents of the bowel naturally will not be evacuated, and what we know as constipation will be the result. Hence any factor that blocks the pathways over which the impulses should travel must be considered as an exciting cause of constipation. There is one such factor that blocks these pathways, namely, a subluxated vertebra in the lower dorsal or upper lumbar region, and a malaligned vertebra must, therefore, be considered as the exciting cause of constipation.

As previously observed, all functions are dependent upon the innervation of the parts engaged in the performance of such functions. Withdrawal of this innervation, in whole or in part, is consequently responsible for virtually all functional disturbances and the symptom complexes incident thereto. And, inasmuch as the denervation of the affected parts is due to a blocking of the pathways *via* which they derive their nerve supply by a subluxated vertebra, it is plain that a malposed vertebra must be held as the exciting cause of many diseases that come under this class.

Fifth, a subluxated vertebra may induce a disease to which the subject has been predisposed by other factors. There are many cases in which a subluxated vertebra becomes the determining factor in the induction of a specific malady. Many examples might be cited in illustration of this, but one common condition, namely, asthma, will suffice. There are a number of predisposing causes of this disease, and though all are evident in a certain individual he may not suffer from the disease. For example, the subject may be a woman, living in a cold, damp climate, be of a nervous temperament, have a hereditary tendency to asthma, and so on, and still be free from the actual manifestations of the disease. On the other hand a certain individual may manifest only one of the commonly accepted predisposing causes of asthma and have the disease in an aggravated form. Why is the person who presents all the predisposing causes free from the disease and the other who manifests only one predispos-

ing cause affected by the disease? There must be some other determining factor that induces the disease in the one who is affected. The reason is not far to seek, and it is based entirely upon the principle of vital resistance. In the subject who remains unaffected, albeit profoundly predisposed to the disease, there is present enough vital resistance of the lungs to enable them to withstand the damaging action of the predisposing factors that surround the individual. In the other case this vital resistance is lacking to a sufficient degree to allow the single predisposing factor that is present to inaugurate the disease. Inasmuch as the vital resistance of a part is in direct ratio to its innervation, it becomes apparent that whatever reduces this induces disease. A vertebral subluxation is the one big factor in depriving a part of its innervation, because, by impinging the nerve to a part it blocks the pathway over which the nerve impulses travel. Hence a malaligned vertebra becomes the determining factor in the production of asthma in those persons who contract the disease. And clinical evidence abounds to show that this is true not alone of the illustration cited, but of many other diseases. Here the clinician is offered a logical explanation of what is so often a perplexing question. He sees one person who, according to all his preconceived ideas on the subject should have the disease, go free, while another who is far less predisposed to it is suffering from the disease. He fails to recognize the inducing cause back of it all, that cause which must come into play to induce the disease on whose borders the individual is hovering. As stated, a subluxated vertebra induces many diseases once an individual is predisposed to them. And their role as the inducing cause of such diseases offers us the most satisfactory explanation for their etiology that has ever been advanced.

Sixth, a subluxated vertebra is often the **perpetuating** cause of disease. The part played by subluxated vertebrae in this relation to a disease process offers a solution to a problem that has been perhaps more perplexing than any other to chiropractors.

It is a common observation that although a certain disease is undoubtedly brought about by a causative factor

other than a subluxated vertebra an analysis of the vertebral column reveals a subluxation in the segment from which the affected part derives its innervation. It has further been noted that correction of such a malposed vertebra is followed by a rapid abeyance of the disorder, while the disease persists if a spinal correction is not made. These findings give rise to three questions: What relation has the subluxated vertebra to the disease and its exciting cause? Why does the adjustment of such a subluxated vertebra influence the course of the disease process? Why does the disease persist when the vertebra is not adjusted even though the cause is removed? A concrete example will perhaps best answer these questions.

Let us suppose that a certain individual suffers an attack of toxic gastritis, and the history of the case shows that six hours previously the patient had eaten some spoiled fish. Common sense will tell us that the fish was the direct cause of the disorder, and that a subluxated vertebra had nothing to do with it. Still when a chiropractor is called some time later, he finds a subluxation of the vertebrae that are always found malaligned in any case of stomach trouble. What relation has the subluxated vertebra to the disease and its exciting cause in this case? A detailed explanation will be found in the chapter on the internal causes of subluxations, but, briefly stated, it is this: When the gastric mucous membrane was irritated by the toxic food it became violently inflamed and over-stimulation of the nerve-endings in the stomach wall followed. The impulses generated as a result of this irritation were sent into the centers in the cord and brain where they gave rise to reactions that created outgoing impulses which returned to the original source of irritation. But these outgoing impulses also passed to every branch of the nerves, and consequently first of all to the posterior division of the spinal nerve, which supplies the ligaments of the vertebral column. In response to the rapid succession of impulses coming to them these ligaments contracted with such rapidity that they finally became tetanically contracted. Once the ligaments became thus contracted they exerted a traction upon the vertebra to which

they were attached, with the result that this vertebra was drawn toward the contracted side.

This brings us to the second question: Why does the adjustment of such a subluxated vertebra influence the course of the disease process? The answer is best arrived at by following the course of the disease we are considering. The outgoing impulses that reach the stomach wall stimulate its musculature to violent contraction as a result of which most of its poisonous contents are expelled. A speedy return to normal should now take place, inasmuch as the causative factor has been removed, but such is by no means always the case. If, however, the subluxated vertebrae are adjusted prompt improvement follows. The reason an adjustment at this time is so effective is that the restorative processes of nature at this juncture would otherwise be hampered on account of the impingement of the nerves and a consequent subnormal innervation of the stomach. Adjustment of the subluxated vertebrae relieved the impinged nerves, gave to the stomach its full quota of innervation, and thereby enabled nature to carry out her restorative designs in the affected organ.

We come now to the third question, and the one which has the most direct bearing on the part played by a subluxated vertebra in perpetuating a disease: Why does the disease persist when the vertebra is not adjusted even though the exciting cause is removed? When in cases like the example under consideration the toxic matter is removed, there is often not a complete return to normal for a long time, perhaps never. How often we trace a case of chronic gastritis, gastric erosions and ulcers to a previous attack of ptomaine poisoning. And yet the original cause has been entirely eliminated, and with it the irritation that it primarily induced. Hence there must be something else in operation to perpetuate the disorder of the stomach, because we know that an irritant cannot produce a definite disease entity—it can induce an inflammatory reaction, and that is all. It is plain that only one factor can have any influence in perpetuating the disorder and that is the subluxated vertebra which will always be found in such cases. Clinical evidence in abundance bears out this contention, and case

after case could be cited in which adjustment brought relief after every other measure had failed. Certainly no stronger evidence of the part played by the subluxated vertebra in perpetuating the disease could be adduced.

We have here an explanation that clears up the etiology of many a disease which persists after removal of all commonly accepted causes of such a disease. The clinician who does not take the action of a subluxated vertebra into account in cases of this kind is hopelessly lost. And it is precisely for this reason that so many persons, while they make a fair recovery from an acute disorder, are "never the same afterward."

To those chiropractors who have hitherto contended that because the adjustment cured the patient the subluxation must have been the cause, and have been led by this false reasoning into many bypaths of error, this exposition should offer a solution that robs their science of none of its lustre and still places it in conformity with all scientific truths.

We thus have in the foregoing six ways in which a subluxated vertebra may act as a cause of disease a logical explanation of the part which it plays in the production of those diseases whose etiology is obscure to others than chiropractors, as well as of virtually all diseases. For it may be said without question that in 90 per cent of all diseases a subluxated vertebra has something to do with their causation in one or another of the ways outlined above. Recognition of these principles offers not alone a logical explanation of the cause of nearly all diseases but the correct clue to its successful management.

How Adjustments Cure Disease

Theoretically, adjustment of subluxated vertebrae brings about a cure of disease by removing impingement from the structures transmitted by the intervertebral foramen. Clinically, there is no question that cure or improvement follows the application of the chiropractic thrust in the vast majority of cases. Much has been written in an attempt to explain exactly how the results arrived at are obtained. A study of the various structures transmitted by the intervertebral foramen indicates that these effects are arrived at in several ways. Likewise, the clinical effect noticed shows

that the application of the thrust accomplishes its effect in other ways than solely by removing pressure from the spinal nerve.

There are four factors at work in bringing about the beneficial results observed in most cases. These may be summarized as follows: (a) stimulation; (b) removal of impingement from the afferent and efferent nerves; (c) restoration of the normal irritability of the spinal segment; (d) conversion of the rigid segment into a movable unit.

There is no question that the immediate, though temporary, effect of the application of the chiropractic thrust is produced as a result of its stimulant action on the nerve centers. As previously stated, each cell is virtually a battery composed of ions in definite relationship to each other. When the cell is deprived of its requisite blood supply there develops a lack of cohesion of the elements composing it. As a result of the concussion of forces incident to the application of the thrust there is a condensation of the ions composing the cell, in consequence of which it functions more actively. In other words, the cell generates impulses as a result of the stimulant it has received in the form of the thrust applied. True, this effect is transitory and does not contribute to the permanent removal of the disorder.

That many of the effects which are noticed following an adjustment must be ascribed to this, cannot be denied. We frequently observe results following the first adjustment, and the fact that the vertebra has slipped back to its former abnormal position to a great extent and that the nerves are consequently impinged, shows that the effect produced could not have been achieved by removal of the impingement from the nerves. Hence those immediate affects which are obtained following the application of the thrust can only be ascribed to the stimulation of the nerve centers by the thrust.

The permanent effect of adjustment of vertebrae is obtained by removing impingement of the spinal and autonomic nerves passing through the intervertebral foramen. These nerves convey stimuli from the periphery to the central axis and from the central axis to the periphery. And unless these pathways are free, neither the afferent nor the

efferent impulses will reach their destination. If the central axis is left unacquainted with the needs of the periphery the necessary impulses will not be generated, because it is a fact that ninety per cent of all outgoing nerve force is generated in response to a stimulus from the periphery. Were this not true there would be no need for receptive nerve endings in the periphery. All that would be required would be outgoing nerves designed to convey impulses to the various parts of the body whose need for such impulses would be appreciated by a central governing intelligence. The fact, however, that there are peripheral nerve endings and that their stimulation excites the generation of impulses shows that these outgoing impulses are in a large measure generated only when the need for such impulses on the part of any structure in the organism is communicated to the central axis. Inasmuch as the functional activity of all parts is dominated by the impulses which it receives from the central axis, and since these impulses are generated only when the central axis is made acquainted of this need, it follows that the pathways over which the ingoing and outcoming impulses are conveyed must be free. Hence adjustment of a subluxated vertebra by removing impingement from these pathways must be considered as the most effective, natural and permanent means of restoring a diseased portion of the organism to health.

The third factor entering into the accomplishment of the result arrived at when a subluxated vertebra is adjusted is the restoration of its normal irritability to the corresponding segment of the spinal cord. It is within the central axis that all incoming stimuli are converted into outgoing impulses. In order that this conversion may occur with proper volume and rapidity, the cells within the central axis must possess a requisite amount of irritability so that they will properly react to the stimuli received from the periphery. This irritability exists only when each segment of the cord is receiving its normal blood supply. The blood affords each segment its nutrition, maintains a normal temperature, and provides an alkaline medium for the nerve structures. When a vertebra is subluxated the vessels to each segment of the cord are impinged and the blood supply

of that segment is altered. As a result, its nutrition suffers, there is a reduction in the temperature, waste products accumulate. In consequence of this the irritability of that segment is proportionately reduced. It does not tranfer incoming stimuli and generate outgoing impulses with normal volume or rapidity. As has already been shown, the cell of each incoming nerve posesses tendrils which arborize about the cell of the outgoing nerves. It is by means of these tendrils that a contact is established between each of these cells, and by which the incoming impulses are transferred from one cell to the other. If this transfer and the consequent reaction eventuating in the generation of outgoing nerve force does not take place, because of the lessened irritability of that segment, the organ, system or part of the body supplied by this segment suffers functionally and organically. By adjustment of the subluxated vertebra the pressure from the vessels is removed, the irritability of the corresponding segment of the cord is brought up to par, and the structure supplied by that segment again receives its normal quota of innervation. There is no question that this contributes very materially to the end results achieved by adjustment of a vertebra.

The fourth factor in the accomplishment of beneficial effects by the chiropractic thrust lies in the fact that through the thrust that is applied rigidity is overcome. It is a well known fact that in all systemic diseases, e.g., typhoid, smallpox, diphtheria, influenza, rigidity of the entire spine is demonstrable. It is likewise true that in all local disorders rigidity of the spinal segment from which the affected part derives its nerve supply is evident. These findings are in accord with similar observations in all parts of the body. The first reaction of any living structure to irritation is rigidity. This being true, it is reasonable to suppose that rigidity would be particularly evident in all or a portion of the spine in various disorders. It is a further fact that when any part of the body loses its elasticity it becomes functionally depraved. All the slowing down of the vital processes in advancing age are due to the fact that the several parts of the organism are suffering a progressive loss of elasticity. Rigidity, therefore, is intimately

connected with and an essential part of functional and organic derangement. Hence, it follows that any measure which can overcome this rigidity will beneficially influence the disorder consequent thereof. Accordingly it is found that removal of spinal rigidity favorably influences the course of many diseases. We are compelled to acknowledge this by clinical findings that are so frequently made. In many cases a vertebra which has been found apparently out of alignment has been seen to occupy exactly the same position after many adjustments had been given, and yet the patient's condition was restored to normal. Evidently, therefore, the end result was arrived at by some means other than replacement of the vertebra in alignment with its fellows above and below. Closer study of the manner in which this may have been brought about will reveal that in all these cases the normal mobility of the vertebra had been restored. For this reason, it is plain that the conversion of a rigid segment into a movable unit contributes something to the sum total of results achieved by the application of the chiropractic thrust.

Retracing

Some chiropractic writers contend that inasmuch as a disease reaches its maximum through gradual stages of development, it must retrace those stages. An attempt is made in this way to explain certain phenomena observed in a considerable number of cases. These phenomena have been given the term "retracing," and while their existence is undeniable the explanation offered heretofore for their occurrence is largely incorrect.

One of the most serious defects in this theory is that it is made too inclusive. Many chiropractors ascribe the development of dangerous symptoms to the fact that the patient is "retracing," and thus fall into serious error in the management of the case.

It is true that many chronic ailments assume acute proportions before they respond to adjustment of the vertebrae. As a matter of fact, there are many disorders which must be changed from chronic into acute before a cure is possible. A good example of this is afforded by various

chronic skin diseases. All dermatologists recognize the fact that it is necessary to convert a chronic into an acute condition before the disorder can be cured. Hence they first use stimulating applications until the chronic condition has become acute and then substitute soothing applications.

It is not, however, necessary that every patient suffering from a disorder of any nature must retrace the stages over which his disease developed before he can be cured. There are many patients who show marked improvement from the first adjustment and progressively improve until entirely cured. Hence it is not an essential that a patient become worse before he becomes better, which is practically what the retracing theory implies.

Advocates of the retracing theory attempt to explain the occurrence of symptoms indicating aggravation of the patient's ailment on the basis of retracing. When we, however, consider the fact that all symptoms in the development of a disease become progressively more aggravated, we should expect that in its recession these symptoms become milder.

There is a great danger in placing too much faith in the principle of retracing. A chiropractor who puts implicit confidence in this theory is apt to overlook the development of serious complications until it is too late to save the patient. Such an attendant might, for example, be very likely to allow a patient suffering from appendicitis to go on until he suffered a rupture of a gangrenous appendix under the mistaken notion that the patient was retracing. The retracing theory must therefore be confined strictly to those cases in which the return to the normal state is through gradual and progressive stages, each of which manifest a note of improvement.

A study of the pathology of most chronic affections clearly shows why certain symptoms manifest themselves during the return to the normal state. In all acute affections there is an inflammatory reaction, while in chronic states there is a hyperplastic condition in the affected part. In most disorders it is necessary that the return to normal proceed in an inverse order to its development. For this reason, the added amount of blood supply in a part during

the time that it is being restored to the normal state stimulates a reaction of inflammation and gives rise to similar symptoms. At this time the patient may believe himself to be growing worse. The attendant who keeps this in mind and advises the patient regarding it will in that way allay the patient's apprehension on this score.

The return to the normal state is not, however, in direct ratio to the return of the subluxated vertebra to its normal position. This is clearly shown in the fact that many patients do not recover entirely until some months after a vertebra has been realigned. This is true for the reason that some time is required for regeneration of nerves which have been impinged for a long period. It is well known that nerve tissue regenerates more slowly than any other. The irritability and conductivity of the nerves do not return to normal in many cases for some length of time after the vertebra has been adjusted and the impingement removed. This explains why many persons do not manifest the results of the adjustments until some months after they have been discharged by their attendant.

The reaction of different individuals to adjustments varies within wide limits. One individual suffering from apparently the same disorder as another may recover in one-half the length of time. A number of factors may be responsible for these variations. Chief among these is the physical makeup of the organism. Each patient is a law unto himself, and the results obtained in each are entirely a matter of the personal equation.

Natural Adaptation

The natural tendency in all diseases is toward recovery. Everything that nature does is designed for the preservation of the organism. She exhibits this in numerous ways, both in health and disease. When one organ, e.g., the lungs, kidneys, becomes affected, the other assumes the task of both. No matter what may be the disorder, there is a natural adaptation to the changed condition, which has for its objective the preservation of the individual.

Correctly speaking, there is nothing intellectual about

this adaptation. It is purely a natural process which is manifested in all divisions of natural life.

Many examples of natural adaptation for the benefit of the organism exist. As a matter of fact, all vital processes are nothing more nor less than adaptation of the organism to its environment. The moment the organism is out of tune with its environment disorganization sets in. This disorganization is of all grades and degrees—from a slight functional derangement to death.

Hence it may be stated that all activities of the organism, in other words, all functions, are adaptative in the sense that they are designed for the well-being of the organism as a whole and for its preservation. A classification of the processes which are purely adaptative will assist the reader to secure a better understanding of this subject and the grouping herewith submitted is made to serve this purpose.

Environment.—Most physiological processes in the organism are of an adaptative nature insofar as they adapt the organism to its environment. For example, when an individual is in a high temperature the cutaneous vessels dilate and radiation of heat and evaporation become more active. When the individual is in a cold temperature the vessels of the skin contract and thus reduce radiation and evaporation from the surface. In this way the heat of the body is maintained at a fixed level at all times regardless of the medium in which the organism is placed.

Protection.—Many natural processes are designed for the protection of the individual from the harmful influences surrounding him. The nervous system is particularly constructed with this in mind so that reactions may occur with a speed not possible when volition enters into the act. This is a splendid illustration of how nature adapts the individual to external influences. For example, when a hot object is touched the hand is instantly withdrawn without a conscious process entering into the procedure, showing that the adaptation is purely natural and not intellectual.

Cooperation.—The nervous system governs the harmonious functioning of all parts of the organism. All organs are interdependent insofar as their functional activ-

ity is concerned. All assist each other and cooperate with each other.

Substitution.—When one organ of a pair (lungs, kidneys) is not functioning at par on account of disease (pneumonia, tuberculosis of kidney) its partner attempts to do the work of both, and thus nature adapts the organism to the changed conditions that exist.

Compensation.—If an organ is structurally affected changes occur so that it can perform its function in spite of this structural handicap, and thus becomes adapted to the performance of its function. This is well illustrated by the hypertrophy and dilatation of the heart in valvular disease. The muscular wall of the heart thickens and certain cavities dilate so that it may overcome the resistance to the flow of blood or the backward leakage and its chambers accommodate the excess which is present.

Elimination.—When any poisons enter the system nature at once sets about to cause their expulsion, and the violent vomiting that takes place in most such instances is designed to accomplish this. A good illustration of this is offered by the vomiting that occurs when spoiled food is eaten.

Conservation.—Nature demonstrates in many ways her desire to conserve space and to adapt certain structures to the space allotted them. This is observed under both normal and subnormal conditions. The brain is made to occupy space only 1/13 the size of what would be required by the fact that its cortex (gray matter) is thrown into folds. The intestines are designed by being convoluted into coils to occupy space 1/20 the size they would require if extended in a straight line. In scoliosis when the thoracic cage is distorted the heart and lungs adapt themselves by altering their position and still functioning normally.

Adjustment.—Under all abnormal conditions nature makes an heroic effort to adapt the organism to the changes affecting it. In old age when the discs become thinned to an extent that reduces the vertical diameter of the intervertebral foramen to an extent that endangers its contents, nature causes the back parts of the vertebrae to separate in such a way as to adapt the spine to changed conditions and prevent closure of the foramen. In tuberculosis of the spine,

when several vertebrae collapse upon each other, nature throws out bony overgrowths in such a manner that occlusion of the intervertebral foramina is prevented. This illustrates not alone nature's powers of adaptation but likewise attests to the importance which she must attach to preserving the patency of the intervertebral foramina.

Immunity.—One of the outstanding examples of nature's means of adapting the organism to external conditions is afforded in the immunity she confers on individuals. It is rare that we have the same infectious disease more than once, because the individual carries with him through life the resistance to the infection which nature builds up during the course of such a disease.

Reflex Action.—All reflex actions may be correctly considered as natural adaptation. These actions are performed without the intervention of the will because of the need for rapid reaction to environmental conditions. The best illustration of this is the reaction of the pupil of the eye to light. No conscious process is involved in the contraction and dilatation of the pupil, which clearly shows that adaptation is not an intellectual process.

Development.—For the performance of certain functions, either under normal or abnormal conditions, there is a natural adaptation of the part for the proper performance of such functions. This is illustrated in the muscular development of the right arm in locomotive engineers.

Repair.—When portions of a structural unit are destroyed nature repairs the part by building it up with new tissue and thus adapting the structure for the continued performance of its function in whole or in part. The union of fractured bones, healing of wounds, etc., illustrate this form of adaptation.

Defense.—Many of the symptoms incident to various diseases are nothing but manifestations of natural adaptation. While such symptoms are very often distressing, it would be unwise to inhibit the process which gives rise to them, because this process may be nature's way of combating a destructive process within the system. For example, in all toxemias a rise in temperature is in part a natural reaction designed for the purpose of overcoming the

toxins circulating in the blood. To reduce a temperature of that kind by mechanical means is simply defeating nature's purposes. Again, violent vomiting and purging in certain gastro-intestinal affections is nature's effort to rid the digestive tract of harmful matter, and measures employed to stop such vomiting and purging obviously should not be used. These and other examples that might be cited show the folly of symptomatic medication and explain its failure to obtain desired results in so many cases. The principle of medication is after all founded on the belief that symptoms are manifestations of depravity on the part of nature. This theory does not take into account the fact that nature is always striving in every possible way to save the organism and to perpetuate the race. The giver of drugs does so in an effort to defeat what he considers from the symptoms an effort of nature to destroy the individual. It is thus apparent how illogical the administration of drugs is in most cases, and how logical is the employment of natural means, founded on the principle that cure must come from the inside and not from the outside of the body.

It is upon this theory that Chiropractic is founded. The principle of Chiropractic holds that nature is striving toward recovery and that anything which will assist her effort in that direction should be employed. Since it is plain that normal natural processes are dependent upon the amount of nerve force which a part receives, restoration of the innervation of a part to it will assist nature in her effort to rehabilitate such a diseased part. This assistance plus the natural adaptiveness represents the real *modus operandi* of all curative processes that occur within the organism.

CHAPTER VII

The Neurological Basis of Chiropractic

In the community of cells which form the human organism, the welfare and activity of each part and the co-operation of all parts is maintained by an apparatus which we call the nervous system. This system consists of nerve-cells which generate, and nerve-fibres which conduct, the nerve-force that engenders all vital phenomena. All nerve-force is generated by the nerve-cell in response to a demand from some part of the organism, and every outgoing impulse is the product of an ingoing impulse. In no case does a nerve-cell automatically generate and discharge nerve-force, and in the absence of any afferent impulses the central nervous system, which contains the nerve cells, would be inert. The function of nerve-cells is, therefore, to act as stations in which occur those reactions which adapt the organism to changes in its environment, and in so doing call into existence the different vital phenomena which the organism manifests. These phenomena include every reaction designed for the activity and preservation of the organism.

Hence functions of any part of the organism are performed in response to an outgoing impulse to action, which impulse was itself generated by the nerve-cell in reaction to an incoming stimulus. Whether this be the sudden withdrawal of a part from a source of danger, the secretion of saliva in response to the sight, smell or taste of food, or the beat of the heart through stimulation of its ganglia by the blood within it, the same fundamental principle is in operation—reaction to stimulus.

It is, therefore incorrect to assume the existence of a dynamic power without form or substance, constantly generating impulses which are carried to the different parts of the body. The mere fact that no part of the organism is functionally active at all times is sufficient evidence to show that it is not receiving a constant flow of nerve-force which

is designed to control its function. Some chiropractic teachers hold that all vital processes are a result of "mental impulses" generated by "innate intelligence." There are, however, a number of reasons tending to disprove this theory and demonstrating beyond question that nerve impulses that call into action the purely vegetative processes of the organism are not generated by innate intelligence.

Perhaps the most convincing reason that it is incorrect to ascribe the generation of nerve impulses to innate intelligence lies in the well-established fact that innate intelligence does not concern itself in any way with the material functions of the different parts of the body. An analysis of the term "innate intelligence" will readily show what is its real purpose. Anything is innate which is inborn, native, natural —as innate vigor, innate intelligence, et cetera. Intelligence in general means understanding or intellect, the term relating exclusively to those qualities of the mind which express themselves consciously to the mind of the one possessing them. Innate intelligence is, therefore, inborn and natural intelligence as distinguished from acquired intelligence which is developed by study and experience.

Both innate and acquired intelligence possess the same functional characteristics—manifesting themselves by conscious, intellectual expression as distinguished from unconscious, physical expression. For the latter a separate nervous mechanism, as we shall presently see, is required. Thus innate and acquired intelligence through their co-operative expression can produce a beautiful painting, but they cannot cause the secretion of gastric juice. A separate and distinct nervous mechanism supplies the nerve-force which induces the secretion of gastric juice, but this nerve-force cannot produce a painting.

Innate intelligence must therefore be considered as concerned entirely with the generation of intellectual force and not nerve force. It is purely a manifestation of the soul, the vital principle, the ego, or whatever term one may wish to give the essence of being of the human organism. This innate intelligence expresses itself in the masterpiece of the artist, the address of the orator, the music of the virtuoso. It does not concern itself with or promote the well-

being of the individual, because it contributes nothing that adapts the organism to changes in its environment, and health is nothing more nor less than perfect adaptability to one's environment. When we are out of harmony with our environment we are diseased.

In view of the fact that the principles of Chiropractic, as taught by some are based on the assumption that the nerve force which activates various parts of the organism consists of mental impulses generated by innate intelligence it will not be amiss to consider at this point the causes leading to this theory.

First and foremost was the failure of the originators of this theory to discover centers in the brain for the control of various organic functions. As is well known, the brain has been mapped out into various regions, each of which contains the cells that preside over certain functions. But among these there is none which presides over the function of the liver, the stomach, the kidneys. Hence it became necessary to search elsewhere for the source of those impulses which were known to exist and to be necessary to the proper functioning of these and other parts of the body.

The correct answer might have been found thereupon had these investigators not been obsessed with the one idea that inasmuch as a vertebral subluxation obstructed the nerve-force, that consequently no other nerve could possibly have anything to do with the affected organ than one that passed through the intervertebral foramen. How otherwise could the subluxated vertebra cause disease and its adjustment cure disease, they argued, if any other nerve than one passing through the intervertebral foramen had anything to do with the well-being and activity of the part? In line with this reasoning they denied that the twelve cranial nerves had anything to do with the function of the organs because they did not pass through the intervertebral foramen. For example, the writer heard a leading chiropractic educator say once that "the optic nerve has nothing to do with vision, because if it did, how is it that a chiropractic adjustment will improve vision when this nerve does not go through any intervertebral foramen?"

The maze of error into which this reasoning was leading these theorists might, however, have been made somewhat less complete had they given proper consideration to the manner in which the nerve impulses were generated. They realized that most of the functions of the organs were of an involuntary character, but they did not admit that a tangible nervous mechanism could generate impulses not connected with conscious volition. They accordingly passed by the autonomic nervous system, denied that the impulses were reflexly generated as a reaction to a stimulus at the periphery, and ascribed their generation to some unseen power which automatically generated nerve force and distributed it as a constant flow to all parts of the body.

We see in these three observations the *raison d'être* of the theory that nerve impulses are generated by an innate intelligence. But, as has already been shown, the only innate intelligence that has any but a hypothetical existence has nothing to do with with the generation of nerve impulses. As a matter of fact an intangible something, as is innate intelligence, could not possibly generate nerve-force. A definitely defined structural apparatus is required for the generation of nerve-force, since the generation of impulses implies a chemical change in the mechanism which generates them. The mere fact that a nerve-cell becomes exhausted shows that the process of generating an impulse involves a change in the constituents of that nerve-cell, and proves that a physical process is required for the generation of an impulse. A familiar example of this is afforded by the inability which one encounters in distinguishing an odor after having smelled a number of different perfumes —indicating exhaustion of the olfactory centers. All this makes it plain that there can be no basis for the assumption that nerve impulses can be generated by a something which has no material existence.

Denial of the need of an innate intelligence to generate a constant flow of mental impulses to regulate the well-being and activities of the organism naturally carries with it the necessity of proving that the nerve-force which accomplishes this objective is generated in another manner and a detailed account of this mechanism may be found in any

standard work on physiology. A topical *résumé* of the subject will therefore suffice.

As has already been observed, all vital phenomena which adapt the organism to its environment are generated as a reaction to stimulus. The vast majority of these reactions occur without the conscious intervention of the will. In other words they are developed reflexly, and for the performance of such a reaction a certain nervous apparatus is required, which is known as the reflex arc. This consists of the following structures: Receptive end-organs of nerves in a part which receive stimuli and generate ingoing impulses; an ingoing nerve which conducts the afferent stimuli to the cells in the spinal cord and brain; cells and association fibres which convert the afferent stimuli into efferent impulses; an outgoing nerve which conducts the efferent impulses to the terminal organ in the part which gave rise to the ingoing stimuli. Over this pathway travel all the impulses which give rise to activity of the part which is stimulated to action.

To give a graphic illustration of the manner in which function is produced by this means a typical example can be cited. One that can be easily traced, and which illustrates how most action is induced throughout the body, is the act of defecation. The rectum is supplied by the third and fourth sacral nerves and by branches from the inferior mesenteric and hypogastric plexuses. Irritation of the nerve-endings in the mucous membrane of the rectum is caused by the presence of fecal matter. The impulses caused thereby run to the spinal defecation center in the lumbar enlargement of the spinal cord, either by way of the sacral nerves or through the sympathetic plexuses, the gangliated cord, and the rami communicantes to the lumbar nerves, through the posterior roots of which they reach the defecation center in the cord. From the defecation center the outgoing impulses follow two courses: first, they descend through the third and fourth sacral nerves and cause inhibition of the circular fibres of the rectum and contraction of the longitudinal muscle. Secondly, the above action is immediately followed by impulses which pursue the autonomic course, through the anterior roots of the lumbar

nerves, the rami communicantes, the gangliated cord, and the inferior mesenteric and hypogastric plexuses, to the rectum. They cause, in succession from above downward, contraction of the circular muscle of the rectum followed by that of the longitudinal fibres. The two series of impulses thus open a way for the passage of the fecal matter, and then force it through the opening. From the foregoing it is plain that the normal action of the bowels is not dependent upon impulses from the brain and that adjustment of a subluxated vertebra relieves constipation, not because it restores the flow of mental impulses to the intestines, but because it repairs the "break" in the reflex arc traversed by the impulses that move the bowels to action.

It has already been shown that there cannot be a constant flow of mental impulses, because this would naturally lead to constant activity of the part to which these impulses lead. The mere fact that a part is not always active in the same degree and to the same extent shows that it is not always receiving the same amount of nerve-force. What determines the amount of nerve-force that is directed to a certain part? The nature of the task which that part is engaged in. An example will illustrate that the amount of nerve-force which a part receives is always commensurate with the amount of work it performs: If one is about to lift an object, an estimate is always made beforehand of the possible weight of the object; if it is heavier than anticipated it will either be lifted with great difficulty or not at all, and if lighter than estimated it will be lifted quickly and easily. In the first case not enough nerve-force was sent to the muscles engaged in the act; in the second instance an excess of nerve-force was supplied these muscles. Precisely the same holds true of all acts performed by any part of the organism, be they conscious or unconscious. As an illustration of the latter no better example is afforded than the increase of the heart-beat when unusual demands are put on this organ.

We see, therefore, that there is an apparatus that supplies nerve-force to all parts of the organism, and that there is no reason for assuming the generation of mental impulses by innate intelligence. If innate intelligence really did dis-

tribute a certain amount of mental impulses to different parts of the body *via* nerves passing through the intervertebral foramina, it would be good practice to adjust the vertebra impinging the nerve that supplies the affected organ and subluxate all other vertebrae, thus diverting all mental impulses to the diseased structure until it was restored to normal. The patent senselessness of this shows in itself how untenable is the theory of generation of a constant flow of mental impulses by innate intelligence.

A very good illustration showing that innate intelligence has nothing to do with the activities of the organs is offered by a case of fracture-dislocation of the fifth and sixth cervical vertebrae recently seen by the writer. The patient, a young man 22 years old, had struck on top his head in diving, and was taken from the water, living, but unable to move a muscle of his body. On examination all motor and sensory functions were found suspended. The X-Ray and Spinal Analysis showed a complete forward dislocation of the fifth and sixth cervical vertebrae, crushing the spinal cord. The motor and sensory symptoms showed that no impulses were passing from the brain along the cord below the point in the neck where it was crushed. Yet his heart, lungs, stomach, liver, kidneys and intestines were functioning. This was shown by the fact that the heart-beat was normal, the food given the patient was digested, the stools showed bile, and urine was being secreted. If these organs were controlled by "mental impulses" it would not have been possible for them to continue functioning when not a single impulse from the brain was passing below the level of the sixth cervical vertebra. This citation alone shows that the organs of the body are not controlled by impulses coming from the brain, and that an entirely separate mechanism presides over them. The patient died three days later, as predicted, from asphyxia due to gradual filling up of the lungs with the bronchial secretion because of the restricted respiration due to paralysis of the respiratory muscles.

From the foregoing it is apparent that the functions of various structures of the organism are governed by impulses that are generated in response to stimuli received from the periphery by the central axis. Subluxation of a vertebra

not only impinges the outgoing nerves but likewise the ingoing nerves and the vessels that supply the corresponding segment of the spinal cord. As a result the reduction of innervation to a part is brought about in a three-fold manner: the afferent stimuli which excite the generation of nerve-force never reach the central axis; the nerve cells do not readily transfer afferent stimuli into efferent impulses; the efferent impulses cannot reach their destination. The functional or organic depreciation that occurs in any part is a result of the combined operation of these three factors. Since the welfare and activity of each unit and the coöperation of all parts of the organism are maintained by the nerve-force which they receive, it follows that any disorders that develop have for their underlying cause a reduction in the nerve-force produced in the manner indicated above. Subluxations of vertebrae thus become the underlying cause of most diseases.

It must be apparent to the reader that the innate intelligence theory does not fit in with anatomical and physiological truths. Hence any deduction made from the assumption that innate intelligence presides over the vegetative processes of the organism cannot be taken seriously. This includes all theories made to fit in with the innate intelligence theory, of which the "Meric System," so called, is an illustration.

This system assumes that the body is divided into twenty-six "Meric Zones." Twenty-four of these zones correspond to the twenty-four movable vertebrae, the twenty-fifth is related to the sacrum and the twenty-sixth to the coccyx. Each vertebra with a pair of spinal nerves superior to it is known as a "Vertemere." Accordingly the atlas with the first pair of spinal nerves is known as the first vertemere and each succeeding one is numbered accordingly.

This theory assumes that each zone is supplied by the corresponding spinal nerve. It excludes the autonomic system and the cranial nerves *in toto*. It denies the existence of reflex action of every kind.

To one possessing an accurate knowledge of anatomy and physiology of the nervous system, the fallacy of the meric system is at once apparent. The intricate intercommunica-

tion of the nerves in itself shows that the various structures of the organism derive their nerve supply from widely separated sources. To consider each part as a separate unit implies a lack of coöperation between various parts of the organism, which is an absolute essential to the well-being of the organism as a whole.

In support of the contention made that the meric system has no foundation in fact, the reader is referred to the second section of this work in which the anatomy and physiology of the nervous system is given in detail, and to the third section of this book, which shows graphically the nerve supply of every structure in the body. A studious consideration of those subjects will suggest many thoughts to the reader tending to show that the meric system has no real existence, and emphasizing the fact that the principles herein set forth of Chiropractic are in accord with all anatomic and physiologic truths.

SECTION TWO

Chiropractic Neurology

CHAPTER I

The Anatomy of the Autonomic Nervous System

A thorough knowledge of the autonomic nervous system is necessary to an understanding of chiropractic theory and technique. This knowledge is also essential to understand how results are obtained by the application of the "thrust" for the adjustment of subluxated vertebrae. A comprehensive study of chiropractic must include the anatomy of this portion of the nervous system in all its ramifications, from the gangliated cords to the finest filaments which supply each cell of the body. It must embrace the exact relationship of the autonomic system with the cerebrospinal system and the cranial nerves. With such knowledge the clinical results of chiropractic will be readily appreciated. Fig. 10.

The autonomic nervous system consists of (1) a double chain of ganglia extending along the front and sides of the spinal column, from the base of the skull to the coccyx, and connected with each other by intervening cords. Each ganglion is reinforced by motor and sensory filaments derived from the cerebrospinal system, and thus the organs under its influence are brought indirectly into communication with external objects and phenomena. (2) Of three great gangliated plexuses or collections of nerves and ganglia, located in front of the spine in the thoracic, lumbar, and pelvic cavities. (3) Of smaller ganglia situated in close relation to the viscera. (4) Of a large number of nerve-fibres which are of two kinds: communicating, by which the ganglia communicate with each other and with the cerebro-spinal nerves; and distributory which supply the internal organs and the coats of the bloodvessels (Gray).

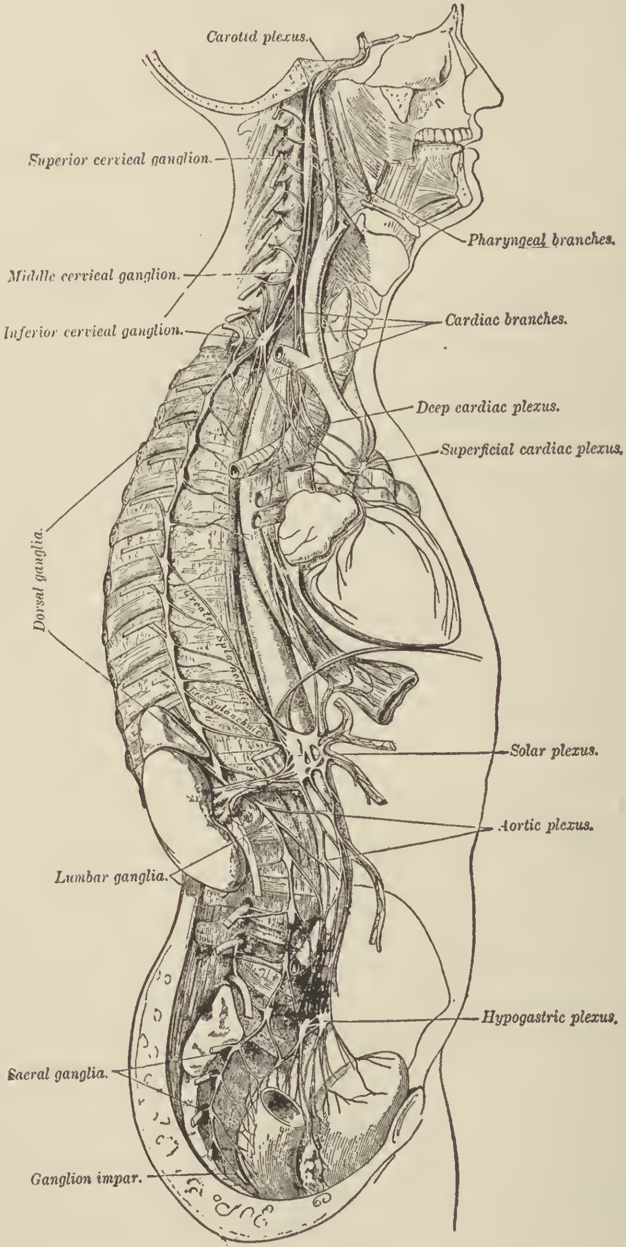

Fig. 10

The Autonomic Nervous System (Gray).

The nerves of the autonomic system are distributed to organs over which the consciousness and the will have no direct control, as the intestines, kidneys, liver, heart, etc. The entire autonomic series is in this way composed of numerous small ganglia which are connected throughout, first, with each other; second, with the cerebrospinal system; and third, with the internal viscera of the body.

The upper end of each gangliated cord enters the cranial cavity through the carotid canal by means of an ascending branch. These ascending branches unite in a small ganglion, known as the ganglion of Ribes, situated upon the anterior communicating artery.

The lower end of each gangliated cord passes into the pelvis. Here the two cords converge and unite in a single ganglion, called the ganglion impar, situated in front of the coccyx.

The ganglia of these cords are classified according to the region in which they are situated, as cervical, dorsal, lumbar and sacral. They correspond in number to the vertebrae against which they lie, except in the cervical region. Thus they are arranged in the following classes: The cervical portion of the gangliated cord has three pair of ganglia; the dorsal portion has twelve pairs; the lumbar portion has four; and the sacral portion has four or five.

In the neck the ganglia are situated in front of the transverse processes of the vertebrae; in the thoracic region, in front of the heads of the ribs; in the lumbar region, on the sides of the bodies of the vertebrae; and in the sacral region, in front of the sacrum.

By many, the ganglia on the posterior roots of the spinal nerves, on the glosso-pharyngeal and vagus, and on the sensory root of the fifth cranial nerve (Gasserian ganglion) are also included as autonomic nerve structures. (Kirks.)

Each portion of the gangliated cord will now be considered in turn.

The **cervical portion of the gangliated cord** consists of three ganglia on each side, which are called, from their position, the superior, middle, and inferior.

The **superior cervical ganglion** is the largest of the three. It is located opposite the second and third cervical verte-

brae, and is supposed to be formed by a coalescence of the four ganglia which correspond to the four upper cervical vertebrae. It has five branches, namely, superior, inferior, anterior, internal, and external. The superior branch is a direct upward extension of the ganglion. It ascends along the internal carotid artery and, on reaching the carotid canal in the temporal bone, enters the cranial cavity, and divides into two branches, an outer and an inner. The outer branch distributes filaments to the internal carotid artery, and forms the carotid plexus; the inner branch also sends filaments to the internal carotid, and, passing onward, forms the cavernous plexus. Filaments are sent from the carotid and cavernous plexuses to cranial nerves. Their terminal filaments extend along the course of the internal carotid artery, forming plexuses which wind about the cerebral and ophthalmic arteries; they can be traced along the former vessel to the pia mater; along the latter vessel they pass into the interior of the eye-ball. As previously stated, the filaments which pass on to the anterior communicating artery form a small ganglion, the ganglion of Ribes, which connects the cords of the right and left sides.

The inferior branch of the superior cervical ganglion passes downward, and communicates with the middle cervical ganglion.

The external branches of the superior cervical ganglion are numerous. They communicate with the cranial nerves and with the four upper spinal nerves.

The internal branches are three in number, namely, the pharyngeal, laryngeal, and superior cardiac nerve. The pharyngeal branches pass inward to the side of the pharynx where they join with branches from some of the cranial nerves. The superior cardiac nerve is formed by two or more branches from the superior cervical ganglion, and also sometimes receives a filament from the communicating cord between the upper and middle cervical ganglia. It runs down the neck behind the common carotid artery, and at the root of the neck divides into the right and the left superior cardiac nerves. The right superior cardiac nerve passes along the innominate artery to the back part of the arch of the aorta, at which point it joins the deep cardiac plexus.

It receives filaments from cranial nerves, and sends filaments of communication with the thyroid branches from the middle cervical ganglion. The left superior cardiac nerve passes along the common carotid artery to the front of the arch of the aorta, where it communicates with the superficial cardiac plexus.

The anterior branches of the superior cervical ganglion wind about the external carotid artery and its branches, on many of which plexuses are formed. Many of these plexuses send important twigs of communication with other nerves.

The **middle cervical ganglion** is formed by the two ganglia corresponding to the fifth and sixth cervical vertebrae. It is often spoken of as the thyroid ganglion on account of its relation to the thyroid artery. It has four branches, superior, inferior, internal, and external.

The superior branches ascend to unite with the superior cervical ganglion.

The inferior branches descend to communicate with the inferior cervical ganglion.

The external branches pass outward and communicate with the fifth and sixth spinal nerves.

The internal branches are known as the thyroid and the middle cardiac nerve.

The thyroid nerve has small filaments which accompany the inferior thyroid artery to the thyroid gland. They also communicate with important nerves.

The middle cardiac nerve arises from the middle cervical ganglion or from the cord which connects the middle and inferior cervical ganglia. It passes down the neck behind the common carotid artery, on the right side; then it accompanies the trachea, gives off filaments to other nerves, and finally joins the right side of the deep cardiac plexus. The middle cardiac nerve of the left side joins the left side of the deep cardiac plexus.

The **inferior cervical ganglion** is formed by the union of the two ganglia which correspond to the last two cervical nerves. It is located between the base of the transverse process of the seventh cervical vertebra and the neck of the first rib, on the inner side of the superior intercostal

artery. It has four branches, namely, superior, inferior, internal, and external.

The superior branches ascend to communicate with the middle cervical ganglion.

Its inferior branches descend to communicate with the first thoracic ganglion.

The external branches are made up of some filaments which communicate with spinal nerves. Other filaments accompany the vertebral artery in its upward course along the vertebral canal; they form plexuses along its course, which in turn give off filaments which are continued upward along the vertebral and basilar to the cerebral arteries.

The internal branch is known as the inferior cardiac nerve. This nerve passes downward along the trachea to join the deep cardiac plexus. It also communicates with the recurrent laryngeal and middle cardiac nerves.

The **thoracic portion of the gangliated cord** is made up of twelve ganglia, corresponding to the twelve thoracic vertebrae, and named in the order of their position as first, second, third, etc. They are connected by cords which are an extension of their substance. All except the last two are situated in front of the heads of the ribs, on each side of the vertebral column. The last two ganglia are placed on the side of the bodies of the eleventh and twelfth thoracic vertebrae. The thoracic ganglia have external and internal branches.

The external branches of the ganglia are two in number, and communicate with the corresponding spinal nerves.

The internal branches from the five or six upper thoracic ganglia send filaments to the thoracic aorta and its branches; also branches to the bodies of the vertebrae and their ligaments. Branches from the third and fourth, and sometimes also from the first and second ganglia form a portion of the posterior pulmonary plexus.

The internal branches from the six or seven lower ganglia send filaments to the aorta, and unite to form the three splanchnic nerves, namely the great, the lesser, and the smallest splanchnics.

The great splanchnic nerve is formed by branches from the thoracic ganglia between the fifth or sixth and the ninth

or tenth ganglia. The fibres from the roots in the fifth or sixth ganglionic branches can be traced upward in the gangliated cords as far as the first or second thoracic ganglia. The nerve descends obliquely inward in front of the bodies of the vertebrae, passes through the diaphragm, and ends in the semilunar ganglion of the solar plexus, sending filaments to the renal and suprarenal plexuses.

The lesser splanchnic nerve is formed by branches from the tenth and eleventh thoracic ganglia and also from the cord between them. It passes through the diaphragm with the great splanchnic, and communicates with the solar plexus. It communicates in the thorax with the great splanchnic, and also occasionally sends filaments to the renal plexus.

The smallest, also called the renal splanchnic nerve, arises from the twelfth thoracic ganglion. It pierces the diaphragm, and terminates in the renal plexus and the lower portion of the solar plexus.

The **lumbar portion of the gangliated cord** is placed in front of the spinal column, along the inner border of the psoas muscle, much nearer the median line than the thoracic ganglia. This portion of the gangliated cord usually consists of four ganglia united by intervening cords. Each ganglion has four branches, namely, superior, inferior, external, and internal.

The superior branches of the lumbar ganglia act as the branches of communication between the ganglia.

The inferior branches act in the same manner as the superior in joining the ganglia with each other.

The external branches communicate with the spinal nerves of this region. There are other filaments which accompany the lumbar arteries passing around the sides of the bodies of the vertebrae.

The internal branches in part pass inward in front of the aorta, helping to form the aortic plexus. Others descend in front of the common iliac arteries and then unite in front of the promontory of the sacrum, assisting to form the hypogastric plexus. Many small filaments are distributed to the bodies of the vertebrae and their ligaments.

The **pelvic portion of the gangliated cord** is located in

front of the sacrum along the inner side of the anterior sacral foramina. It is made up of four or five ganglia, united by intervening cords. Below, these cords approach each other and then unite on the anterior aspect of the coccyx in a ganglion called the ganglion impar. The sacral ganglia have the same branches as the preceding, namely, superior, inferior, external, and internal.

The superior and inferior branches constitute the cords connecting the ganglia above and below.

The external branches communicate with the sacral nerves. There are two from each ganglion. The coccygeal nerve communicates either with the last sacral or with the ganglion impar.

The internal branches communicate with those of the other side, on the front of the sacrum. Some pass onward to join the pelvic plexus, while others form a plexus about the sacra media artery, and send filaments to Luschka's gland.

The gangliated cords and their branches of communication and distribution to the plexuses having been described, we will now direct our attention to the consideration of the great gangliated plexuses, which constitute the second of the four divisions of the autonomic system, as outlined above.

The **three great gangliated plexuses** are the large aggregations of ganglia and nerves, situated in the thoracic, abdominal, and pelvic cavities. They are called the cardiac, the solar or epigastric, and the hypogastric plexus, respectively. The nerves which enter into their composition are derived from the gangliated cords and from the cerebrospinal nerves. From these plexuses branches are distributed to the stomach, small and large intestine, liver, spleen, pancreas, kidneys, supra-renal capsules, and the internal generative organs, bladder, heart and lungs, thyroid gland, pharynx, larynx, trachea, and esophagus.

The **cardiac plexus** is situated at the base of the heart. It is divided into a superficial part which lies in the concavity of the arch of the aorta, and a deep part which lies between the aorta and the trachea. These two plexuses are very closely connected.

The *deep* cardiac plexus is situated in front of the bifur-

cation of the trachea, above the point of division of the pulmonary artery, and behind the arch of the aorta. It is formed by the cardiac nerves which are derived from the cervical ganglia of the autonomic system, and from the cardiac branches of the pneumogastric and recurrent laryngeal nerves. The only cardiac nerves which do not enter into the formation of the deep cardiac plexus are the left superior cardiac nerve and the inferior cervical cardiac branch from the left vagus.

Some of the branches from the right side of this plexus pass in front of the right pulmonary artery, while others pass behind it. The former send a few filaments to the anterior pulmonary plexus, and then proceed onward to form a part of the anterior coronary plexus.

The branches from the left side of the deep cardiac plexus send filaments to the superficial cardiac plexus, to the left auricle of the heart, and to the anterior pulmonary plexus, and then continue onward to form the greater part of the posterior coronary plexus.

The *superficial cardiac* plexus lies under the arch of the aorta, in front of the right pulmonary artery. It is formed by the left superior cardiac nerve, by the inferior cervical cardiac branch from the left vagus, and lastly by filaments from the deep cardiac plexus. A small ganglion, the ganglion of Wrisberg, is sometimes connected with these nerves, and, when present, is located just beneath the arch of the aorta. The superficial cardiac plexus together with the deep, as mentioned above, forms the anterior coronary plexus, the former entering principally into its formation. Several filaments also pass along the pulmonary artery to the left anterior pulmonary plexus.

The *posterior coronary* plexus surrounds the branches of the coronary artery at the back of the heart, and filaments from it are distributed to the muscles of the ventricles.

The *anterior coronary* plexus passes forward between the aorta and the pulmonary artery, and accompanies the coronary artery on the front of the heart.

Some anatomists have found nervous filaments ramifying beneath the endocardium (Valentin). In some mammalia numerous small ganglia exist on the cardiac nerves both

on the surface of the heart and in its muscular substance (Remak).

The **epigastric or solar plexus** consists of a great network of nerves and ganglia, situated behind the stomach, and in front of the aorta and the crura of the diaphragm. It supplies all the viscera of the abdominal cavity. It surrounds the celiac axis and the root of the superior mesenteric artery, and extends down as far as the pancreas and outward as far as the suprarenal capsules. The solar plexus and the ganglia connected with it receive the great and small splanchnic nerves of both sides and some filaments from the right vagus.

Of the ganglia which partly compose the solar plexus the principal are the two semilunar ganglia, which are located one on each side of the plexus, and are the largest ganglia in the body, being sometimes referred to as the "Abdominal Brain." They are large, irregular gangliform masses, formed by a collection of smaller ganglia. They are situated in front of the crura of the diaphragm, near the suprarenal capsules. The upper part of each ganglion is in communication with the great splanchnic nerve, and to the inner side of each the branches of the solar plexus are connected. From the semilunar ganglia a multitude of radiating and intertwining branches are sent out, which, from their diverging course and their common origin from a central mass are termed the solar plexus. From the solar plexus other diverging plexuses originate, which accompany the abdominal aorta and its branches and are distributed to the stomach, large and small intestine, liver, spleen, pancreas, kidney, suprarenal capsules, and the internal organs of reproduction. These plexuses are the following:

Phrenic or Diaphragmatic plexus.
Suprarenal plexus.
Renal plexus.
Spermatic plexus.
Superior mesenteric plexus.
Aortic plexus.

$$\text{Celiac plexus} \begin{cases} \text{Gastric plexus.} \\ \text{Splenic plexus.} \\ \text{Hepatic plexus.} \end{cases}$$

The *phrenic* plexus arises from the upper part of the semilunar ganglion. It receives one or two branches from the phrenic nerve. It is larger on the right side than the left. It accompanies the phrenic artery to the diaphragm which it supplies, and then sends some filaments to the suprarenal capsule. At its junction with the phrenic nerve, on the right side is a small ganglion named the ganglion diaphragmaticum, which is situated on the under surface of the diaphragm near the suprarenal capsule. The branches of this ganglion are distributed to the inferior vena cava, suprarenal capsule, and the hepatic plexus. There is no ganglion on the left side.

The *suprarenal* plexus is formed by branches from the solar plexus, semilunar plexus, splanchnic and phrenic nerves, a ganglion being located at the junction with the former nerve. It supplies the suprarenal capsule. The large size of the branches of this plexus in comparison with the small organ which they supply is of much clinical significance.

The *renal* plexus is formed by branches from the solar plexus, the outer part of the semilunar ganglion, and the aortic plexus. Filaments from the lesser and smallest splanchnic nerves also join it. There are about fifteen or twenty nerves from these sources, and they have numerous ganglia upon them. They accompany the branches of the renal artery into the kidney, some filaments being distributed to the spermatic plexus on both sides, and to the vena cava inferior on the right side.

The *spermatic* plexus is derived from the renal plexus, and also receives some filaments from the aortic plexus. It accompanies the spermatic vessels to the testes. In the female the ovarian plexus corresponds to the spermatic of the male, and is distributed to the ovaries and the fundus of the uterus.

The *celiac* plexus is a direct continuation of the solar plexus, and is of large size. It surrounds the celiac axis, and subdivides into the *gastric, hepatic,* and *splenic* plexuses. It receives branches from the splanchnic nerves, and, on the left side, a filament from the vagus.

The *gastric* or *coronary* plexus accompanies the gastric

artery along the lesser curvature of the stomach, and unites with branches from the left vagus nerve. It supplies the stomach.

The *hepatic* plexus is the largest of the divisions of the celiac plexus. It receives branches from the left vagus and the right phrenic nerves. It enters the substance of the liver in company with the hepatic artery and the portal vein, and passes through the organ ramifying upon all their branches. In this manner the pyloric plexus is formed, which accompanies the pyloric branch of the hepatic artery and joins with the gastric plexus and the vagus nerves. There is also the gastro-duodenal plexus which further subdivides into two plexuses, namely the pancreatico-duodenal and the gastro-epiploic. The pancreatico-duodenal plexus accompanies the pancreatico-duodenal artery to supply the pancreas and duodenum, and joins with branches from the mesenteric plexus. The gastro-epiploic plexus accompanies the right gastro-epiploic artery along the greater curvature of the stomach and anastomoses with the branches from the splenic plexus. The cystic plexus also arises from the hepatic plexus near the liver and supplies the gall bladder.

The *splenic* plexus is formed by branches from the celiac plexus, the left semilunar ganglia, and the right vagus nerve. It accompanies the splenic artery and its branches to the substance of the spleen, and, in its course, gives off filaments to the pancreas, forming the pancreatic plexus, and the left gastro-epiploic plexus which accompanies the left gastro-epiploic artery along the convex border of the stomach.

The *superior mesenteric* plexus is a continuation of the lower part of the solar plexus, and receives a branch from the union of the right pneumogastric nerve with the celiac plexus. It ramifies about the superior mesenteric artery and accompanies it into the mesentery, where it divides into several secondary plexuses. These plexuses are distributed to the corresponding parts supplied by the artery, namely, pancreatic plexus to the pancreas; intestinal branches which supply the entire small intestine; and ileocolic, right colic, and middle colic which supply corresponding parts of the large intestines. There are situated upon

these nerves at their origin numerous ganglia.

The *aortic* plexus is formed by branches which are derived on each side from the solar plexus and semilunar ganglia, and also receives filaments from some of the lumbar ganglia. The aortic plexus is situated upon the front and sides of the aorta, between the superior and inferior mesenteric arteries. This plexus gives off the spermatic, inferior mesenteric, and hypogastric plexuses. It also distributes filaments to the inferior vena cava. The inferior mesenteric plexus which arises principally from the left side of the aortic plexus, surrounds the inferior mesenteric artery. It gives off a number of secondary plexuses which are distributed to all the parts which are supplied by that artery, namely, the left colic and sigmoidal plexuses which supply the descending colon and sigmoid flexure; and the hemorrhoidal plexus which supplies the upper part of the rectum, and joins with the pelvic plexus in the pelvis.

The hypogastric plexus supplies the viscera of the pelvic cavity. It is formed by the union of many filaments, which descend on each side from the aortic plexus and the lumbar ganglia. It is situated in front of the promontory of the sacrum, between the common iliac arteries. No ganglia are demonstrable in this plexus. It divides below into two portions, which descend on each side to form the pelvic plexuses.

The *pelvic* plexus is situated at the side of the rectum in the male, and at the side of the rectum and the vagina in the female. It supplies the viscera of the pelvic cavity. It is formed, as stated above, by the downward continuation of the hypogastric plexus; also by branches from the second, third, and fourth sacral nerves, and by a few filaments from the first two sacral ganglia. At the points where these fibres join there are situated a few ganglia. The branches from this plexus are very numerous, accompany the branches of the internal iliac artery, and are distributed to all the organs of the pelvis.

The *inferior hemorrhoidal* plexus arises from the back part of the pelvic plexus. It supplies the rectum, and unites with branches from the superior hemorrhoidal plexus.

The *vesical* plexus arises from the front part of the pelvic plexus. The nerves which make up this plexus are very

numerous, and a large number of spinal nerves are contained among them. They accompany the vesical arteries, and are distributed to the base and sides of the bladder. Many filaments also pass to the seminal vesicles, and the vas deferens. Those fibres which accompany the vas deferens unite with branches from the spermatic plexus on the spermatic cord.

The *prostatic* plexus is a prolongation of the lower part of the pelvic plexus, and the nerves composing it are of large size. They are distributed to the prostate gland, seminal vesicles, and the erectile tissue of the penis. The nerves which supply the erectile structure of the penis are in two sets, the large and small cavernous nerves. They are slender filaments, and after uniting with branches from the internal pudic nerve, pass forward below the pubic arch. The large cavernous nerve passes along the dorsum of the penis, unites with the dorsal branch of the pudic nerve, and supplies the corpus cavernosum and spongiosum. The small cavernous nerves pass through the fibrous covering of the penis near its roots.

The *vaginal* plexus arises from the lower part of the pelvic plexus, and is distributed to the walls of the vagina. The nerves which make up this plexus are similar to those of the vesical plexus in that they contain a large number of spinal nerves.

The *uterine* plexus arises from the upper part of the pelvic plexus, above the part where the sacral nerves unite with this plexus. Its branches accompany the uterine arteries, passing along between the folds of the broad ligaments, to the sides of the uterus. They pass to the lower part of the body of the uterus and to the cervix. Separate filaments pass to the body of the uterus and the broad ligaments. Branches which pass into the substance of the organ have upon them numerous ganglia.

CHAPTER II

The Autonomo-Spinal System

In the preceding chapter there were considered the chain of ganglia and the nerves of communication between the ganglia, forming, together, the gangliated cords; also the three great gangliated plexuses whose nerves are derived from the gangliated cords and the cerebrospinal nerves; lastly the smaller ganglia which are situated in relation with the viscera and serve as additional centres for the origin of nerve fibres which penetrate the substance of the organs of the body.

From the description which was given, it can be readily appreciated what a tremendous influence the autonomic nervous system must have upon the life processes of these organs. Not only do these nerves regulate the proper functioning of the viscera, but the cellular integrity of the organs depends upon the unimpeded and unhampered action of this portion of the nervous system.

This is true for the reason that the autonomic and the cerebrospinal nervous systems are not two distinct and separate systems, but are united with each other in the most intimate manner. Thus they constitute in reality one system which is continuous from the centres in the brain to the minute fibrils that guide the destinies of each individual cell.

The exact manner in which these two systems are connected will be shown in this chapter. Previous to taking up the consideration of the branches of communication between the cerebrospinal and autonomic systems, however, a brief review of the cerebrospinal system must be given.

It must be constantly borne in mind that when the nervous system is described as being formed of a central and a peripheral portion, and the peripheral portion is further subdivided into a spinal and an autonomic portion, that such subdivisions are only for the purpose of facilitating topographical descriptions. The nervous system is

shown by dissection to be continuous throughout its entire extent, and by virtue of this continuity it puts into connection with each other all the other systems of the body.

The cerebrospinal system consists of the following divisions:

1. The brain; (a) cerebrum; (b) cerebellum; (c) pons varolii; (d) medulla oblongata.
2. The spinal cord.
3. The cranial nerves.
4. The spinal nerves.
5. Branches of communication.
6. Branches of distribution.

The **brain** is the central organ of the nervous system. It is the seat of origin of most of the impulses which pass to all parts of the body and receives the incoming impulses. The brain generates the impulses which govern the vital processes of the body economy, and which impulses are transmitted along the course of the nerves, finally reaching every cell in the body.

The **spinal cord** is the prolongation of the brain, in the vertebral canal. It is an elongated, cylindrical bundle of nerve tracts which convey the impulses to the brain from the various parts of the body, and from the brain to the different parts of the body. At regular points along its course it gives off the roots of the spinal nerves.

The **cranial nerves** are the twelve pairs of nerves given off by the brain, which pass out of the cranial cavity through foramina in the skull; they then pass directly to the organ which they supply.

The **spinal nerves** are so named because they originate from the spinal cord, and are transmitted through the intervertebral foramina. There are thirty-one pairs of spinal nerves, which are classified according to the region of the spine through which they pass, as follows:

Cervical	8 pairs	Sacral	5 pairs
Dorsal	12 pairs	Coccygeal	1 pair
Lumbar	5 pairs		

It will be noticed that the number of spinal nerves corresponds to that of the vertebrae of the corresponding region except in the cervical and coccygeal regions.

Each spinal nerve is formed by two roots, an anterior or motor root, and a posterior or sensory root. The anterior root is efferent, the posterior is afferent. The latter is distinguished by the presence upon it of a ganglion, called the spinal ganglion.

The Anterior Root.—The superficial origin is from the antero-lateral columns of the cord, each root being composed of from four to eight filaments. The real origin is in the anterior horns of the spinal cord. The anterior roots are smaller than the posterior, having no ganglion, and their fibrils are collected into two bundles near the intervertebral foramen.

The Posterior Root.—The superficial origin is from the postero-lateral fissure of the cord. The real origin is from the nerve-cells in the ganglion on the posterior root, from which they can be traced into the cord in two main bundles. The posterior roots are larger than the anterior because there are more sensory nerves than motor in the body, but the individual fibrils composing the root are finer than those of the anterior root. The fibrils which compose the posterior roots pass outward, and merge into two bundles which enter the ganglion on each root. This ganglion is situated on the posterior root at a point just internal to the place of junction of the posterior root with the anterior in the vertebral canal, and is located within the intervertebral foramen, external to the point where the nerves perforate the dura mater. Three exceptions to this location of the spinal ganglion exist; the ganglion upon the first and second cervical nerves is placed on the arches of the vertebrae over which the nerves pass; the ganglia of the sacral nerves are located within the spinal canal; that of the coccygeal nerve is also in the spinal canal, at some distance from the origin of the posterior root.

Distribution of the Spinal Nerves.—The two roots unite just beyond the ganglion, their fibres become blended, and the trunk thus formed constitutes the spinal nerve. The spinal nerve passes through and then out of the interverte-

bral foramen, and divides into an anterior division for the supply of the anterior part of the body, and a posterior division for the supply of the posterior part of the body. Each of these divisions contains fibres from both roots.

The anterior divisions of the spinal nerves are larger than the posterior divisions. In the dorsal region the anterior divisions of the spinal nerves are separate from each other, and are of uniform distribution; but in the cervical, lumbar, and sacral regions they form plexuses prior to their distribution. They supply the muscles and skin in front of the spine.

The posterior divisions of the spinal nerves are usually smaller than the anterior. All except the first cervical, fourth and fifth sacral, and the coccygeal divide into internal branches. These branches are distributed to the skin and muscles behind the spine.

The Autonomic Rami.—The only portion of the autonomic system not yet considered are the branches of communication between the cerebrospinal nerves and the ganglia of the gangliated cords of the autonomic nervous system. It is this important phase of the subject which we will now consider.

The autonomic fibres are like the spinal, both efferent and afferent, and it is by means of these fibres that the two systems are united.

The efferent or white branches of communication between the ganglia of the autonomic system and the cerebrospinal nerves arise in the spinal cord; they pass out in the anterior root, and then into the spinal nerve. Here they join the afferent fibres which originate in the spinal ganglion. The united fibres then pass on into the anterior primary division of the spinal nerve. They leave this, and now known as the white rami communicantes, they pass *to* the ganglion of the gangliated cord of the corresponding situation.

The afferent or gray branches of communication between the autonomic ganglia and the spinal nerves pass *from* the ganglion of the autonomic cord to the spinal nerve, and are called the gray rami communicantes. They may extend separately from the white rami, or both kinds of fibres may

be contained in a single bundle. The gray rami pass through the anterior primary division of the spinal nerve to the spinal nerve proper, and then accompany it throughout all its divisions.

The autonomic fibres that pass through the intervertebral foramen are contained in the substance of the spinal nerve.

From the above the exceedingly intimate connection and interdependence of the autonomic system and the spinal nerves is readily seen. Branches pass from the spinal nerve to the autonomic ganglion, and from the ganglion to the spinal nerve, resulting in a double interchange taking place between the two systems.

The branches between the autonomic ganglia themselves consist of both gray and white nerve fibres, the latter being a continuation of the efferent fibres which pass from the spinal nerves to the ganglia.

The following table shows the portion of the gangliated cord that connects with each of the spinal nerves:

Spinal Nerve		Autonomic System
Cervical	1	External branch from the superior cervical ganglion
"	2	External branch from the superior cervical ganglion
"	3	External branch from the superior cervical ganglion
"	4	External branch from the superior cervical ganglion sometimes also from the cord connecting the superior and middle cervical ganglia
"	5	External branch from the middle cervical ganglion
"	6	External branch from the middle cervical ganglion
"	7	External branch from the inferior cervical ganglion
"	8	External branch from the inferior cervical ganglion
Dorsal	1	Two external branches from the first thoracic ganglion
"	2	" " " " " second " "
"	3	" " " " " third " "
"	4	" " " " " fourth " "
"	5	" " " " " fifth " "
"	6	" " " " " sixth " "
"	7	" " " " " seventh " "
"	8	" " " " " eighth " "
"	9	" " " " " ninth " "
"	10	" " " " " tenth " "
"	11	" " " " " eleventh " "
"	12	" " " " " twelfth " "

Spinal Nerve		Autonomic System							
Lumbar	1....	Two	external	branches	from	the	first	lumbar	ganglion
“	2....	“	“	“	“	“	second	“	“
“	3....	“	“	“	“	“	third	“	“
“	4....	“	“	“	“	“	fourth	“	“
“	5....	“	“	“	“	“	fifth	“	“
Sacral	1....	“	“	“	“	“	first	sacral	“
“	2....	“	“	“	“	“	second	“	“
“	3....	“	“	“	“	“	third	“	“
“	4....	“	“	“	“	“	fourth	“	“
“	5....	“	“	“	“	“	fifth	“	“
Coccygeal............		Either with the last sacral or the coccygeal ganglion							

CHAPTER III

The Autonomo-Cranial System

The Cranial Nerves.—Prior to a consideration of the connection of the autonomic nervous system with the cranial nerves, a brief review of the cranial nerves themselves will be given so as to make the connection more clearly defined.

The cranial nerves arise from certain parts of the brain, and are transmitted through foramina in the base of the cranium. They are named numerically according to the order in which they pass through the dura mater lining the base of the skull. Other names are also given to them, according to their function or the particular system, organ, or part of the body which they supply.

Taken in their order, from before backward, they are as follows:

1st—Olfactory.	7th—Facial.
2nd—Optic.	8th—Auditory.
3rd—Motor oculi.	9th—Glosso-Pharyngeal.
4th—Trochlear (Pathetic).	10th—Pneumogastric (Vagus).
5th—Trifacial (Trigeminus).	11th—Spinal accessory.
6th—Abducens.	12th—Hypoglossal.

All the cranial nerves have two points of origin, a superficial or apparent, and a deep or real origin. The superficial origin is from some part on the surface of the brain. The deep origin is from a special centre of gray matter, called a nucleus, deeply situated in the substance of the brain. The nerves, after emerging from the brain at their apparent origin, pass through openings in the dura mater, leave the skull through various foramina, and then pass on to their final distribution.

The Autonomic and the Cranial Nerves.—Reference to any standard work on anatomy will inform the reader of the fact that the superior cervical ganglion communicates with all the cranial nerves. That this relation is an ex-

ceedingly intimate and intricate one will be shown by the following description of the branches of communication between these two portions of the nervous system.

We have seen that the superior cervical ganglion is situated in front of the transverse processes of the second and third cervical vertebrae; also that it is formed by the coalescence of the four ganglia corresponding to the upper four cervical vertebrae. The communicating branches which connect the ganglion with the spinal nerves are what make the ganglion continuous with the cerebrospinal system, and permit of the passage of impulses from the brain to the ganglion, and from it to its various branches of distribution. The branches of communication are four in number, and connect with the four upper cervical spinal nerves. We saw that the autonomic fibres pass through the intervertebral foramen in the substance of the spinal nerve; therefore, a subluxation of one of the four upper cervical vertebrae will produce a direct pressure upon these branches in the intervertebral foramen, and prevent the transmission of impulses from the brain, through the communicating branch to the ganglion. The absence of these impulses to the superior cervical ganglion will inevitably cause abnormalities in the parts supplied by its branches of distribution, because we know that upon the proper innervation through the autonomic system depends the health of any part of the body.

The **superior cervical ganglion** is the first ganglion of the gangliated cord of the autonomic nervous system, and has the following five branches: superior, inferior, internal, external, and anterior.

The *superior branch* is a direct upward prolongation of the ganglion. It ascends by the side of the internal carotid artery, and, entering the carotid canal in the temporal bone, divides into two branches, an outer, which forms the carotid plexus, and an inner, which forms the cavernous plexus.

The *carotid* plexus communicates with the Gasserian ganglion of the fifth cranial nerve from which are derived the ophthalmic, superior maxillary, and inferior maxillary nerves, with the sixth nerve, the spheno-palatine ganglion which gives off branches to the nose, palate and orbit, and with the tympanic branch of the glosso-pharyngeal nerve

which supplies the mucous membrane of the tympanum, the Eustachian tube, and the mastoid cells. The communicating branches with the sixth nerve consist of one or two filaments which join that nerve at the point where it lies on the outer side of the internal carotid. The communication with the spheno-palatine ganglion is through the vidian nerve which is formed by the large deep petrosal nerve, a branch of the carotid plexus, uniting with the great superficial petrosal. The branches of communication with the tympanic nerve are the small deep petrosal nerve and the carotico-tympanitic. The Gasserian ganglion is united with the carotid plexus by a few filaments from the latter.

The *cavernous* plexus communicates with the third, the fourth, the ophthalmic division of the fifth, and the sixth cranial nerves, and with the ophthalmic ganglion. The branch of communication with the third nerve is at the point where the latter divides; the branch of communication with the fourth nerve unites with it as it lies on the outer wall of the cavernous sinus; other filaments are connected with the under surface of the ophthalmic nerve; and a second filament of communication unites with the sixth nerve; the filament of communication with the ophthalmic ganglion arises from the anterior part of the cavernous plexus.

The *external* branches of the superior cervical ganglion are numerous, and send off branches of communication with the ganglion of the trunk of the pneumogastric nerve, and the hypoglossal nerve. Another filament from the cervical ganglion subdivides and joins the petrosal ganglion of the glosso-pharyngeal nerve and the ganglion of the root of the pneumogastric nerve in the jugular foramen.

The *internal* branches are three in number: the pharyngeal, which pass inward to the side of the pharynx, where they join with branches from the glosso-pharyngeal, pneumogastric, and external laryngeal nerves; the laryngeal, which unite with the superior laryngeal nerve and its branches; the superior cardiac, the right division of which receives filaments from the external laryngeal nerve at about the middle of the neck; lower down, one or two twigs from the pneumogastric; and as it enters the thorax it is

joined by a branch from the recurrent laryngeal; the left superior cardiac nerve ends in the cardiac plexus.

The *anterior* branches of the superior cervical ganglion ramify upon the external carotid artery and its branches, forming delicate plexuses about them on the nerves composing which small ganglia are sometimes found. The plexus that surrounds the external carotid communicates with a branch of the facial nerve; the plexus that surrounds the facial artery sends one or two filaments to the submaxillary ganglion, the sensory root of which is derived from the lingual nerve, and the motor root from the chorda tympani, both branches of the fifth cranial nerve; the plexus that accompanies the middle meningeal artery sends off branches that pass to the otic ganglion of the fifth cranial nerve, and the geniculate ganglion of the seventh cranial nerve.

We have seen that the branches of communication between the spinal nerves and cranial nerves are efferent or white, and afferent or gray. The white rami communicantes of all the thoracic spinal nerves and the first two lumbar spinal nerves connect directly with the corresponding ganglia of the gangliated cord. The first thoracic spinal nerve, however, sometimes fails to connect in this manner. Above the first or second thoracic pair of nerves, therefore, and below the second lumbar pair, however, there is a different distribution of the white rami communicantes.

The white rami that are given off by the cervical spinal nerves and the cranial nerves do not unite with the ganglia of the gangliated cords, but pass directly to the terminal ganglia of the autonomic nervous system. The white rami of the lumbar spinal nerves, below the second lumbar pair, also pass directly to the terminal ganglia. The sacral spinal nerves, also, send their white rami to the terminal ganglia, instead of first joining with the ganglia of the gangliated cord.

Some of the branches of communication between the ganglia of the gangliated cord corresponding to the upper six thoracic vertebrae continue upward to unite with the superior cervical ganglion. It is by means of these fibres that the upper portions of the gangliated cords are supplied from the spinal system. It will be remembered that the

white rami that connect the ganglia of the gangliated cords are a direct continuation of the white fibres in the anterior divisions of the spinal nerves. Since there is no direct connection with the ganglia and the cervical spinal and cranial nerves by such fibres, an indirect connection is produced by the white fibres, which pass uninterruptedly upward from the upper six thoracic segments to the superior cervical ganglion.

It is through the existence of these fibres of white rami communicantes in the gangliated cord that the cranial nerves are influenced by any interference with the normal flow of nerve impulses as a result of subluxations of any of the upper six dorsal vertebrae. It is for this reason that adjustments in the upper dorsal region influence the ear, eye, nose, throat, and any other parts or organs of the body supplied by the cranial nerves.

In like manner, some of the fibres of the white rami of the gangliated cord below the level of the sixth thoracic ganglion and down to the second lumbar, which have a direct communication with the spinal nerves of the corresponding region, pass downward, and in that manner supply the lower portions of the gangliated cords of the autonomic nervous system.

The gray rami communicantes from the superior cervical ganglion communicate with all the cranial nerves. Some of the fibres of the gray rami pass to the origin of the cranial nerves in the brain, while others accompany the nerves throughout all their distribution. The connection between the superior cervical ganglion and the upper thoracic ganglia of the gangliated cord, therefore, makes it possible to correct any functional derangement of all the cranial nerves. Examples of a clinical nature to show that this is being done by means of chiropractic are exceedingly numerous.

The cranial nerves all connect through communicating fibres with the first four cervical spinal nerves. These spinal nerves also are connected with the superior cervical ganglion of the autonomic system by means of the gray rami. The superior branch of the superior cervical ganglion communicates with the ganglion on the root, and the ganglion of the trunk of the pneumogastric nerve. There is thus

established a connection between the cranial nerves and the vagus by means of the autonomic fibres. This connection is well illustrated by the following example: An individual witnesses an accident; the optic nerve conveys the impression to the visual centers in the brain; the sight of the accident produces nausea; the nausea is simply a sympathetic disturbance produced as a result of the connection between the optic nerve and the vagus. The relation between gastric and ocular disturbances may also be reversed; thus the visual disorders accompanying gastric disturbances are readily explained when the connection between the nervous mechanism controlling each part is understood.

The following table shows the connection between the cranial nerves and the autonomic and spinal nervous system:

1st—Olfactory.—The olfactory nerve receives fibres from the first to fourth cervical spinal nerves which receive gray rami from the superior cervical ganglion of the gangliated cord. It also connects with the autonomic system through the vagus, which receives fibres from the superior cervical ganglion, which in turn communicates with the first four cervical spinal nerves. Communication with the upper thoracic ganglia also exists through the ascending fibres of white rami connecting with the superior cervical ganglion.

2nd—Optic.—The optic nerve is connected with the first and fourth spinal nerves which receive gray rami from the superior cervical ganglion. The optic also is connected with the ganglion on the trunk of the vagus which receives filaments from the external branches of the superior cervical ganglion. Terminal filaments from the carotid and cavernous plexuses extend along the internal carotid artery, forming plexuses which entwine around the cerebral and ophthalmic arteries; the latter plexus passes into the orbit, and there forms another plexus which accompanies the arteria centralis retina; the arteria centralis retina supplies the optic nerve, and the nutrition of this nerve is thus controlled by the superior cervical ganglion.

3rd—Motor Oculi.—The motor oculi nerve receives a branch from the cavernous plexus.

4th—Trochlear.—The trochlear nerve receives a branch from the cavernous plexus.

5th—Trigeminus.—The Gasserian ganglion receives branches from the carotid plexus; the otic ganglion receives branches from the plexus surrounding the middle meningeal artery; the spheno-palatine ganglion connects with the superior cervical ganglion through the large deep petrosal nerve from the carotid plexus; the ophthalmic ganglion receives a branch from the anterior part of the cavernous plexus, and then accompanies the nasal nerve; the submaxillary ganglion receives branches from the plexus surrounding the facial artery.

6th—Abducens.—The abducens nerve receives branches from the carotid and cavernous plexuses.

7th—Facial.—The geniculate ganglion communicates with the autonomic plexus on the middle meningeal artery through the external superficial petrosal nerve, with Meckel's ganglion through the large superficial petrosal nerve, and with the otic ganglion through the small superficial petrosal nerve. The facial nerve also communicates with the auditory nerve in the internal auditory meatus; with the auricular branch of the pneumogastric in the Fallopian aqueduct; with the glosso-pharyngeal, the pneumogastric, the auricularis magnus, and the auriculo-temporal at its exit from the stylomastoid foramen; with the small occipital behind the ear; with the three divisions of the fifth on the face; and lastly with the superficial cervical in the neck.

8th—Auditory.—The auditory nerve receives a branch from the geniculate ganglion, which connects with the superior cervical ganglion through the external petrosal nerve; it also connects with the upper thoracic ganglia of the gangliated cord through the connection of the ascending fibres of the white rami with the superior cervical ganglion.

9th—Glosso-pharyngeal.—The petrous ganglion receives a branch from the superior cervical ganglion of the autonomic; Jacobson's nerve receives a branch from the carotid plexus of the superior cervical ganglion; there is also a branch of communication with the pneumogastric; namely one to its auricular branch and one to the ganglion of the root of the vagus; lastly, it communicates with the facial nerve.

10th—Pneumogastric.—The pneumogastric nerve com-

municates in the thorax with the pharyngeal, laryngeal, cardiac, pulmonary, and esophageal plexuses; in the abdomen with the solar, celiac, gastric, hepatic, and splenic plexuses; the ganglion of the root of the pneumogastric communicates with the autonomic system by means of the external branch of the superior cervical ganglion; the ganglion of the trunk also unites with external branches from the superior cervical ganglion; the recurrent laryngeal branch unites with the right superior cardiac nerve, which is one of the internal branches of the superior cervical ganglion; the external laryngeal and one or two other twigs from the pneumogastric also unite with the right superior cardiac nerve; the recurrent laryngeal and external laryngeal nerves also communicate with thyroid branches from the middle cervical ganglion; the vagus also sends branches of communication with the first and second cervical spinal nerves.

11th—Spinal accessory.—The spinal accessory is connected with the ganglion of the root of the vagus by a few fibres; it also communicates with the cervical spinal nerves; it is continuous with the vagus to the pharyngeal and laryngeal branches of the latter; some few filaments are continued into the trunk of the vagus and distributed with the recurrent laryngeal and the cardiac nerves.

12th—Hypoglossal.—The hypoglossal nerve unites with external branches from the superior cervical ganglion; it also has a branch from the first and second cervical spinal nerves; it gives off a branch to the ganglion of the trunk of the vagus; it also communicates with the lingual nerve.

Since all the cranial nerves connect with the superior cervical ganglion, it is easily comprehended how they are influenced by subluxations in the cervical or upper thoracic regions. The connection between the cranial nerves and autonomic system is as intimate as that between the spinal nerves and the autonomic system. Therefore, any interference with the conduction of impulses from one system to the other or anything which prevents a harmonious action, will produce disturbances in the portions of the body supplied by the part of the autonomic system involved in subluxation of a vertebra.

CHAPTER IV

The Physiology of the Nervous System

(Functions of the Afferent System)

Having established the connection between the cerebrospinal and the autonomic nervous system, it now becomes necessary to consider the physiology of the nervous system. The physiology of every portion of this, the governing mechanism of the body, must be thoroughly understood, for upon such a knowledge depends a proper conception of disturbed functions or organic changes in any organ, part, or system of the body. In considering this subject the function of each topographical division of the nervous system will be taken up separately. It must be constantly borne in mind, as previously pointed out, that from a physiological viewpoint no such divisions exist, but that the cerebrospinal and autonomic systems constitute an entity, both anatomically and physiologically. The separation of one from the other is purely for convenience of description. In the present chapter therefore, the function of the cerebrospinal system will be considered.

The Origin of Nerve Impulses.—The basic principle underlying the study of the physiology of the nervous system is this: that in the brain and spinal cord, being the central axis of the nervous system, all impulses either originate or are received. That is to say, all efferent or out-going impulses are generated in the brain or cord; and all afferent or incoming impulses terminate in the brain or cord.

The functional activity and the organic integrity of every part of the body are governed and maintained by the efferent impulses, which originate in the central axis, and are transmitted along the course of the nerve-fibres to their proper destination. The proper relationship of all parts of the body, individually and collectively, to their environment, is maintained by the flow of afferent impulses from the periphery to the central axis.

The Function of the Nerve-Fibres.—The office of nerve-fibres is to convey impulses. This is made possible by reason of their inherent property of irritability and conductivity. The impulse conveyed by the nerve is the resultant of a stimulus applied to the end organ of the nerve in the central axis or periphery. The effect of this stimulus is produced at the termination of the nerve which carries the impulse created by the stimulus. The effect of the stimulus, therefore, depends upon the nature of the end organ of the nerve.

A nerve-fibre is either afferent or centripetal, or efferent or centrifugal. The same fibre cannot be used for the one purpose at one time, and for the other at another. For example, if a cerebrospinal nerve-fibre is irritated by electrifying it, there is but one of two effects—either pain is produced, or there is twitching of a certain muscle or muscles governed by fibres from this nerve. Therefore, when a nerve is thus irritated, there is either an impulse conducted by it to the brain, when there is pain; or there is an impulse conveyed to the muscle, when there is movement.

As a result of the unvarying effects of such stimulation, nerves have been classed as sensory and motor. However, such a classification of nerve function is not broad enough, since the nerves have other functions. The electrification of nerves is an artificial stimulus, and while the results of such a stimulus are either pain or movement, the natural stimuli on centripetal nerves do not always produce pain, nor is movement always produced when stimuli are applied to a centrifugal nerve. But the effects vary, and, as stated above, depend upon the nature of the end-bulb or plate of the nerve stimulated.

The effects of excitation of an afferent or centripetal nerve may accordingly be classed as follows:

(a) Pain or other form of sensation.
(b) Touch.
(c) Taste.
(d) Smell.
(e) Hearing.
(f) Sight.

(g) Temperature.
(h) Muscular sense.
(i) Reflex action of some kind.
(j) Inhibition, restraint of action.

The effects of stimulation of an efferent or centrifugal nerve are the following:

(a) Contraction of muscle (motor nerve).
(b) Influence on nutrition (trophic nerve).
(c) Influence on secretion (secretory nerve).
(d) Inhibit, augment, or stop another efferent action.

Sensations.—Sensations are the result of the stimulation of certain centres in the brain, by irritations conveyed to them by afferent nerves. By means of these sensations the mind obtains a knowledge of the existence both of the various parts of the body, and of the external world. For the production of these sensations, three structures are necessary: first, a peripheral organ for the reception of the impression; second, a nerve for conducting it; third, a nerve-centre for feeling or perceiving it.

These sensations are classed as, (a) Common and (b) Special.

What principally distinguishes them is that by the common sensations the individual is made aware of certain conditions of various parts of his body; while from the special sensations he gains a knowledge of the external world also. This difference can be illustrated by comparing the sensations of pain and touch, the former being a common, while the latter is a special sensation. If we touch the skin with the point of a pin, we feel the point by means of our sense of touch; we perceive a sensation, and think of the object which caused it. But if we puncture the skin with the point of the pin, a pain is felt, a feeling which is felt within ourselves, and by this sensation we are not able to determine what the object was that caused this sensation, because a sensation of pain does not refer to the pin, but simply to the fact that there is a changed condition of the body.

It must be remembered that the seat of sensation is in the sensorium in the brain, and not in the particular end-

organ which receives the impression. Thus we say that we see with our eyes and hear with our ears; but these organs merely receive the impressions, which being transmitted to the optic and auditory centres in the brain are there perceived as sensations and interpreted.

If, for example, the free flow of impulses through the optic nerve is interrupted, sight is lost, because, although the retina receives the impressions, the connection between it and the sensorium is broken. A subluxation in the upper cervical region of the vertebral column, by causing an interference with the gray rami connection between the cervical spinal nerves and the superior cervical ganglion of the autonomic system, will cause the impressions made upon the retina to be imperfectly conveyed to the sensorium and defective vision results. It is for this reason that spinal adjustment in the upper cervical region so often relieves impaired vision.

The cause of excitation of some part of the brain may be some object of the external world, which is termed an objective sensation. Or, the cause of the excitation may be due to some excitement in the brain itself, when it is called subjective. We habitually refer all sensations received to the external causes, even when they are in reality subjective. In this way illusions are produced, such as hearing musical sounds when the auditory nerve is irritated, or seeing various unreal objects during delirium. External influences may also produce illusions of sensation; for example, a blow causes the seeing of "stars" by the eye, a sense of ringing of the ears, a salty taste on the tongue, and a shock over the entire body.

Common Sensations.—These include sensations which cannot be referred to any special part of the body, and are classed as follows:

(a) Discomfort (including a sensation referred to the fauces and stomach).
(b) Fatigue.
(c) Faintness.
(d) Hunger.
(e) Thirst.

(f) Satiety.

(g) Irritations of the bronchial mucous membrane, producing coughing.

(h) Sensations from various viscera which indicate a necessity to expel their contents, as, defecation, urination, labor in the female.

(i) Itching, creeping, tingling, burning, tickling, aching, (some of which come under the head of pain).

(j) Muscular sense.

(k) Touch is the connecting link between the common and special sensations.

Special Sensations.—These are the following:

(a) Touch.

(b) Taste.

(c) Smell.

(d) Hearing.

(e) Sight.

Touch.—The sense of touch renders us conscious of the presence of a stimulus, from the mildest to the most severe form, by that something which we term feeling, or common sensation. The end-organs of all sensory nerves are in reality also organs of touch, and upon their irritability depends the acuteness of this sense. All parts of the body are therefore susceptible to touch, especially the skin, tongue, and lips.

The three varieties of touch are: (1) Touch proper, tactile sensibility or pressure; (2) Temperature; (3) Pain.

Many of the varieties of common sensation mentioned above come under the head of touch, as hunger, thirst, satiety, irritations, weight, itching, creeping, tingling, etc., when not amounting to actual pain.

All these varieties of touch sensibility are dependent on normal irritability and conductivity of the afferent nerves from the periphery to the sensorium. Pressure upon the nerves transmitted by the intervertebral foramen will consequently cause disturbances of the sense of touch, the clinical significance of which will be explained further on.

Temperature.—The entire surface of the body is more or less sensitive to differences of temperature. The power of discriminating temperatures may remain when the sense of touch is temporarily lost; this shows that there are special nerves and nerve-endings for temperature.

The nerves of temperature convey the sensation that a given object is cooler or warmer than the skin. The temperature of the skin is thus the standard. This varies from hour to hour according to the activity of the cutaneous circulation. The vaso-motor nerves of the autonomic system govern the circulation, and when their function is in abeyance, vaso-dilation with increased surface temperature results. This physiological fact is the basis of the "Heat Test," used in spinal analysis, for when a nerve is compressed by a certain vertebra, the skin of the segment of the back corresponding thereto is found to be warmer, and it is a fact that at such segments subluxations can be invariably found.

Subjective Sensations.—These, which are dependent upon internal causes, are very frequent in the sense of touch. All sensations of heat and cold, pleasure and pain, lightness and weight, fatigue, etc., may be produced by internal causes. Examples of subjective sensations are, sensations of chilliness, creep of ants (formication), etc. The mind has a wonderful faculty of exciting sensations in the nerves of common sensibility. Thus the thought of something nauseating produces the feeling of nausea; and the idea of pain will give rise to pain in a part predisposed to it.

Pain.—There are various views concerning which nerves and nerve-endings convey this sensation. That there is a special pain sense with special nerves and end-organs is not likely. The sensation of pain is most probably due to an over-stimulation of a nerve of special sensation or its end-organ.

Muscular Sense.—It is by means of this sense that we are made aware of the condition of the muscles, and thus obtain the information required for adjusting them to various purposes—standing, walking, grasping, etc. This muscular sensibility is shown by our power to estimate the difference between weights by the different muscular efforts

required to raise them. This sense must be distinguished from the sense of contact and of pressure, for the skin is the organ of these.

We have the power of determining beforehand the amount of nervous influence necessary for the production of a certain degree of movement. Thus when we lift a vessel the force which we employ in lifting it depends upon the idea which we have formed of its contents, when we are not certain what it contains. If it should, therefore, contain something much lighter than we had estimated, useless force would be expended, and it would be lifted with exceptional ease; but if it contain something much heavier than we had anticipated, we would very likely drop it, because insufficient force was expended to accomplish the end desired. This proves that the amount of nerve influence generated by the brain must always be commensurate with the amount of work required of the parts supplied by the nerves. Just as the response of muscles is proportionate to the amount of nerve force received by them, so also are the functional activities of all other parts of the body dependent on this influence. Anything, therefore, which interferes with the conduction of the requisite amount of nerve force for the performance of its function by any organ, necessarily must be considered the primary factor in the production of disease of that organ.

Taste.—There are three conditions necessary for the perception of taste: First, the presence of a specially endowed nerve-centre and a nerve to conduct the stimulus produced; this stimulus is the result of the production of a change in the condition of the gustatory nerves, and this stimulus being conducted to the nerve-centre produces the sense of taste. Second, the matters to be tasted must either be in a state of solution or be readily dissolved by the moisture of the tongue; for this reason dry powders are usually tasteless, and merely produce a sensation of touch on the tongue. Third, the surface with which these matters come in contact must also be moist, and the temperature be of about 100° F.; therefore, when the tongue or fauces are dry, substances are tasted with difficulty, even though they be moist.

Taste, like any other sensation is perceived in the sensorium in the brain, and is usually referred to the tongue; but the soft palate, uvula, tonsils, and throat are also endowed with taste. These parts derive their sense of taste from the glosso-pharyngeal nerve, branches of which supply them. Besides the sense of taste, the tongue also is endowed with the sense of touch; it may lose either of these senses and retain the other. This shows that the nervous conductors for these two different sensations are distinct, and since the glosso-pharyngeal nerve also contains fibres of common sensation, as well as the fifth nerve which supplies the tip of the tongue with taste, the same nerve trunk may contain fibres having entirely different properties.

Smell.—The conditions necessary to the sense of smell are the following: First, a special set of nerves and nerve-endings, the changes in whose condition produce stimulation of a special nerve-centre which perceives the sensation of odor. The same substance which excites the sense of smell in the olfactory centre may also cause another sensation through the nerves of taste, and produce a burning sensation on the nerves of touch. Second, the matters which stimulate the nerve-endings which are either finely divided particles floating in the air or are in the form of gaseous vapors, must first be brought into solution, for which purpose the mucous lining of the nose must be moist. When the Schneiderian membrane is dry, the perception of odors is lost, and thus in the first stage of nasal catarrh, when the mucous secretion in the nostrils is diminished, the sense of smell is imperfect or lost. Third, it is also essential that the odorous matter be transmitted through the nostrils in a current. This is accomplished by breathing through the nose with the mouth closed; we are thus able to control the sense of smell, for by interrupting the respirations we can prevent the perception of odors; in like manner the perception of odors is increased by rapid inspiration, as sniffing.

The sense of smell is conveyed by the olfactory nerves. These nerves connect with the superior cervical ganglion of the autonomic system, as do all the cranial nerves, and spinal adjustment in the cervical and upper dorsal regions restore the sense of smell as well as of taste in a great many

instances, where no actual destruction of the nerve centres has occurred.

Hearing.—The essential part of the organ of hearing is the internal ear. The other two portions, namely the external and middle ear, are merely accessory. The sense of hearing is produced by the exposure of the filaments of the auditory nerve to sonorous vibrations. The auditory nerve filaments are distributed within the labyrinth of the inner ear, which consists of a set of cavities in the petrous portion of the temporal bone. The labyrinth contains peculiar cells, called rod-cells, which vibrate in unison with certain tones and thus strike a particular note, the sensation of which is carried to the brain by those filaments of the auditory nerve with which the auditory apparatus is connected.

Subjective sounds are produced by any irritation of the auditory nerve or other portions of the auditory apparatus. Thus are explained the buzzing and ringing sounds heard by those individuals suffering from nervousness, cerebral disease, vascular congestion of the head and ear, and irritation of the auditory nerve.

The auditory nerve, being connected with the superior cervical ganglion of the gangliated cord of the autonomic system, may be influenced by adjustment of subluxated vertebrae in the upper cervical and upper thoracic regions. Some cases, however, do not respond, and when this is so, it is due to pathological changes in the internal ear as a result of long-continued catarrh.

Sight.—The sense of sight is produced by the following process: A ray of light reflected from any object causes vibrations of the luminiferous ether which are transmitted through the iris of the eye; these rays then pass through the refractive media of the eye-ball and finally impinge upon the retina; the endings of the nerves of sight in the retina, namely the rods and cones, convey the impulse thus produced to the optic nerve, which transmits the sensation to the visual centres of the sensorium in the brain; here the size, form, etc., of the object are correctly interpreted or estimated.

Numerous instances are on record pointing to the marked

influence exerted by the autonomic system upon the optic nerves, as shown by the clinical results achieved by adjustment of subluxated vertebrae in the cervical and upper dorsal regions.

Reflex Action.—This is an action depending upon the power possessed by nerve-cells of sending out to the periphery impulses along efferent nerves in response to impulses reaching them from afferent nerves. It is supposed that when an impulse reaches a nerve-cell, a change in its metabolism occurs, resulting in a discharge of energy. This discharge is conducted out along the course of an efferent nerve as a stimulus, which differs in the action which it produces according to the nature of the terminals of the nerve; the action which is produced may be secretory, motor, nutritive, etc. Such reflex act may be limited in its effect, or it may be extensive. Those reflex movements which occur independently of sensation are generally called excito-motor; those which are guided or accompanied by sensation, but not constituting an intellectual process, are called sensori-motor.

The following things are necessary for the development of every reflex action: (a) One or more perfect afferent fibres to conduct an impression received at the periphery; (b) A nerve centre for receiving the impression, and by which it may be reflected; (c) One or more efferent fibres along which the impression is conducted outward; (d) The tissue by which the effect of the action is manifested. For the production of a reflex act there must therefore be two perfect, unimpinged neurons, a sensory or afferent, and a motor or efferent one.

Essentially all reflex actions are involuntary, although most of them are capable of being modified, controlled, or prevented by a voluntary effort of the will.

Reflex actions which are performed in health have a distinct purpose, and are adapted to producing some end which is desirable and necessary for the well-being of the body; in disease, however, many of them are irregular and purposeless.

In the simplest form of reflex action it may be supposed

that a single efferent and afferent neuron are concerned. But in the majority of actual reflex actions many neurons are very likely engaged. The impulse is carried by collaterals up and down to different levels of the cord, and thus a number of groups of cells are affected.

The reflex effect produced by the stimulation of a sensory surface, depends not alone on the strength of the stimulus, but also upon the condition of the nerve-centre, and upon the unimpeded conductivity of the nerves involved in the action.

The result of stimulation of a reflex centre may be not only an outgoing impulse which stimulates the parts controlled by its peripheral endings to activity. It may also prevent or stop an action already going on, or it may augment, make more powerful or extensive, or increase in a certain direction an action already going on.

Automatism.—This is an automatic action which is not dependent for its discharge upon an afferent stimulus, but is produced by the nerve-centre which of itself sends out efferent impulses of various kinds. The nerve-centre is supposed to do this by the nature of its own metabolism—the building up of the explosive substance being anabolic, while the discharge of this force is katabolic. This is the kind of impulses which are constantly going out and keep the muscles in a state of continuous contraction or tone.

Inhibition and Augmentation.—Not only may the movements of muscles, the discharge of secretions from glands, and other actions be the result of afferent impulses stimulating the nerve-centres, but inhibition of such action which is already going on may be produced. This is well illustrated by the inhibitory action of the vagus upon the contractions of the heart. The vagi convey to the heart impulses from the cardio-inhibitory centre which have a restraining action upon the activity of the heart; thus it is that appropriate afferent stimuli, as, for example, when applied to the abdominal autonomic, may increase the action of the centre to such an extent as to altogether stop the heart during diastole. The action of almost any other centre may be inhibited in like manner by impulses reaching it; or conversely, if appropriate stimuli fail to reach it, its action is

disturbed, and the inhibitory action is destroyed, so that the heart, for example, beats very rapidly when all afferent impulses are prevented from reaching the cardio-inhibitory centre as a result of a vertebral displacement in the upper cervical or upper dorsal regions of the spinal column.

CHAPTER V

The Physiology of the Nervous System

(Functions of the Efferent System)

A thorough knowledge of the efferent function of the nervous system is as essential as that of the afferent nerves, for upon such a knowledge depends a proper appreciation of the results of any interference with their action. Such interference, produced by pressure upon the nerves at the intervertebral foramina, prevents their conduction of impulses, and we have seen that upon these impulses depends the action which takes place at the terminations of the nerves. Derangement of the function of the different parts of the body is a result of such impeded nerve action.

Efferent Action of Nerves.—The effects of stimulation of an efferent or centrifugal nerve are the following: (a) Contraction of muscle (motor nerve). (b) Influence on nutrition (trophic nerve). (c) Influence on secretion (secretory nerve). (d) Inhibit, augment, or stop another efferent action. The various kinds of action under each of these heads will be separately considered.

The Motor Functions.—Every movement made by any part of the body depends upon the contraction of a muscle as a result of an efferent impulse to it from the nerve which controls it. Thus, every conscious and unconscious act performed by the human organism is accomplished through the medium of a muscle or group of muscles. It is through muscular action, dependent upon nerve impulses, that we stand erect, have the power of locomotion, that the face has expression, that the heart forces the blood onward, that respiratory movements occur, that the viscera, as the stomach and intestines, move and perform their functions, that the secretions of the glands are produced, and so on. There must necessarily be some controlling influence which guides the definite and proper action of the muscles, and it is the brain or spinal cord which acts in this capacity, by generating impulses which are transmitted along the nerves.

All the movements outlined above are governed by a separate and distinct centre in the brain, and depend for their performance upon an impulse sent from this centre along the course of a special nerve, to the muscle which produces it. Anything which prevents the uninterrupted conduction of this impulse prevents action taking place in that part of the body for which the particular impulse was destined.

Not only are movements of the muscles dependent upon impulses originating in the brain, namely efferent impulses, but they are also produced as a result of those external influences upon the periphery which cause a reflex action. The afferent impulse being changed to an efferent one, as occurs in a reflex action, produces a contraction of a certain muscle, depending upon the spinal segment involved.

The two forms of motion possessed by all muscles are contraction and relaxation. While the muscle is contracted, it is rigid; while it is relaxed, it is lax. When the nervous system is perfectly intact, there is a continuous flow of efferent impulses which maintain the muscles in a state of constant contraction. This produces an exactly balanced state of contraction on corresponding portions of each lateral half of the body. If there is a disturbance of the centre in the brain, or if there is an interference with the flow of these impulses, or if there are reflex disturbances, this harmonious balance is disturbed, and is followed by a greater contraction of the muscles of one side of the body than of those of the other side. This is very clearly shown in facial paralysis where the muscles of one side of the face are relaxed and are consequently drawn to the other side by the action of the muscles of the unaffected side, by the constant contraction present in the latter.

As an example of interference with the conduction of the impulses controlling this state of muscular contraction, we may consider a subluxation of a vertebra. This subluxation causes impingement of the nerves passing through the corresponding intervertebral foramen; these nerves send branches to the ligaments and muscles of the spinal column; as a result of the impingement of the nerves, the impulses which are necessary to maintain the muscles of that segment of the spine do not reach the muscle, and it becomes

relaxed; the opposite side, not being affected, draws the bones, namely the vertebrae, toward that side, and draws the vertebra out of its proper alignment. We see in this fact the basis for the permanence of a subluxation until corrected by mechanical means.

We are daily exposed to various forms of irritation which produce stimuli upon the peripheral endings of afferent nerves. The impulses thus generated are transferred to an efferent nerve-fibre and produce contraction of the muscle controlled by the segment affected. For example, the irritant may be a draught of cold air striking the surface; this stimulus to the afferent nerves reflexly produces a contraction of the muscles of one side of the neck, making them rigid. This contraction of one side may produce a subluxation of a cervical vertebra; this may be so slight that it will be spontaneously relaxed during sleep; but if sufficient impingement of the nerves is produced, the misplacement may be permanent, and lead to various disorders of function of the parts supplied by that particular segment of the vertebral column.

The Trophic Function.—The second efferent action of nerves enumerated is their influence on nutrition. Nutrition or assimilation is probably the most universal of the five properties of all living matter. By this term we designate the series of changes through which dead matter is received into the structure of living substance. In its broadest sense it includes the subsidiary processes of digestion, respiration, absorption, secretion, excretion, anabolism, and katabolism.

Assimilation and disassimilation, or anabolism and katabolism, go hand in hand, and together constitute an ever-recurring cycle of activity that persists as long as life lasts. It is designated under the name metabolism. In most forms of living matter metabolism is in some way self-limited, so that it gradually becomes less perfect, then old age comes on, and finally death follows.

The Secretory Function.—The function of gland cells is to produce certain substances called secretions. These materials are of two kinds, namely, those which are designed to perform a certain function in the economy, and those which are discharged from the body as useless or injurious.

In the former case the materials formed are termed true secretions, in the latter they are termed excretions.

The secretions do not exist in the same form in the blood, but require a special process and special cells for their production, *e.g.,* the glands of the stomach for the formation of gastric juice, the mammary gland-cells for the formation of milk, and so on. The excretions, however, consist of substances which exist ready-formed in the blood, and are merely abstracted from it.

Every secreting apparatus possesses three essential parts; a basement membrane, certain cells, and blood-vessels. These three structural elements are arranged in various ways, but all the varieties come under two classes, namely, membranes and glands.

The principal secreting organs are the following: 1, the serous and synovial membranes; 2, the mucous membranes with their special glands, as the buccal, gastric, and intestinal glands; 3, the salivary glands; 4, the pancreas; 5, the mammary glands; 6, the liver; 7, the lachrymal glands; 8, the skin; 9, the kidneys; 10, the testes; 11, the ovaries; 12, the thyroid gland; 13, the adrenals; 14, the pituitary body; 15, the spleen.

The process of secretion is greatly influenced by the nervous system. It has this influence by virtue of its power of increasing or diminishing the blood-supply of secreting organs; also it exercises a direct influence upon the gland-cells themselves, which may be called a trophic influence. Its influence on secretion may be excited by causes acting directly upon the nerve-centres, upon the nerves going to the secreting organ, or upon the nerves of other parts. In the last-named case the action produced is reflex; thus the contact of food with the mucous membrane reflexly excites a free flow of saliva. Various conditions of the brain also may stimulate the nerves of secretion, such as the mere thought of food exciting a flow of gastric juice, the tears excited by sorrow or excessive joy, the discharge of urine in hysterical paroxysms, etc. Further facts regarding the nervous mechanism of secretion will be given in the chapter on the function of the autonomic system.

Inhibition and Augmentation.—These functions of ef-

ferent nerves have been considered in the previous chapter, since they depend for their production upon the excitation of a nerve-centre by a stimulus carried to it by an afferent nerve. The impulse which produces various forms of inhibition or augmentation at the terminals of the nerves is a centrifugal one. Thus the vagi convey to the heart from the cardio-inhibitory centres impulses which restrain its contractions.

The Cranial Nerve Functions.—The physiology of the First, Second, and Eighth cranial nerves has been considered under the special senses. We will now briefly consider the function of the others.

According to their several functions the cranial nerves may be classed as follows:

(a) Nerves of special sense—Olfactory, Optic, Auditory, part of the Trigeminal, and part of the Glosso-pharyngeal.

(b) Nerves of common sensation—The greater part of the Trigeminal.

(c) Nerves of motion—Motor Oculi, Trochlear, lesser division of the Trigeminal, Abducens, Facial, and Hypoglossal.

(d) Mixed nerves—Glosso-pharyngeal, Pneumogastric, and Spinal accessory.

The 1st Nerve, or Optic, is the nerve of sight.

The 2nd Nerve, or Olfactory, is the nerve of the sense of smell.

The 3rd Nerve, or Motor Oculi, supplies the levator palpebrae superioris muscle, and all the muscles of the eye-ball except the superior oblique and external rectus; also the iris and ciliary muscle. The functions of the eye derived from the impulses through this nerve are, accommodation, contraction of the pupil, and movement of the eye-ball.

The 4th Nerve, or Trochlear, has only a motor function, supplying the superior oblique muscle of the eye-ball.

The 5th Nerve, or Trigeminal, is a nerve of special and common sensation, and motion. The first and second divisions are purely sensory; the third, or non-gangliated division is both motor and sensory. Its motor portion supplies the muscles of mastication. Its sensory portion supplies all the anterior and antero-lateral parts of the face and head except the skin of the parotid region. It also confers com-

mon sensibility to the organs of special sense. It also provides the muscles with that sensibility without which the mind, being unconscious of their position and state, cannot exercise them. The fifth nerve, further, has a trophic influence over the organs of special sense.

The 6th Nerve, or Abducens, is exclusively motor and supplies the external rectus muscle of the eye.

The 7th Nerve, or Facial, is the motor nerve of all the muscles of expression, including the platysma, and those muscles of mastication not supplied by the fifth nerve; also the parotid gland, and some of the muscles of the soft palate. By its tympanic branches it supplies the stapedius and laxator tympani; and through the optic ganglion, the tensor tympani; through the chorda tympani it sends branches to the submaxillary gland and to the lingualis and some other muscular fibres of the tongue, and to the mucous membrane of its anterior two-thirds; and by branches given off before it reaches the face it supplies the muscles of the external ear, the posterior part of the digastric and the stylohyoid. The facial nerve is also a secretory nerve, as it sends fibres to the submaxillary and parotid glands.

The 8th Nerve, or Auditory, is the nerve of hearing through its cochlear branch, and of equilibrium through its vestibular branch.

The 9th Nerve, or Glosso-Pharyngeal, contains some motor fibres together with those of common sensation and the sense of taste. The motor fibres are distributed to the palato-pharyngeus, stylo-pharyngeus, palato-glossus, and constrictors of the pharynx. Sensory fibres influence the parts which it supplies, and an afferent nerve conveys impressions inward to be reflected to the adjacent muscles. The 9th nerve, together with the chorda tympani and the gustatory, are the nerves of taste, not of themselves, but through their connection with the Fifth nerve. Numerous experiments have shown that when nerve impulses are prevented from passing through the fifth nerve, the sense of taste is lost; this is instantaneous when the nerve is severed, and consequently cannot be attributed to defective nutrition of the parts; but it is due to this fact when the nerve is compressed or prevented from transmitting the necessary impulses as a result of a vertebral subluxation.

The 10th Nerve, or Vagus, has the most varied distribution and functions of all the nerves. By its branches it supplies the following parts: its pharyngeal branches, which enter the pharyngeal plexus, supply the mucous membrane and muscles of the pharynx. By the superior laryngeal nerve it supplies the mucous membrane of the under surface of the epiglottis, the glottis, the greater part of the larynx, and the crico-thyroid muscle. Through the inferior laryngeal nerve are supplied the mucous membrane and muscles of the trachea, the lower part of the pharynx and larynx, and all the muscles of the larynx except the crico-thyroid. By its esophageal branches are supplied the mucous membrane and muscular coat of the esophagus. Through the cardiac nerves the vagus supplies a large portion of the heart and great vessels. By the anterior and the posterior pulmonary plexuses the lungs are supplied. Its gastric branches supply the stomach. Through its hepatic and splenic branches the liver and spleen are partly supplied. Its terminal branches supply the intestines and kidneys.

The vagus nerve contains both sensory and motor nerve-fibres throughout its whole course. Its many functions, briefly considered, are as follows: (a) motor, to the larynx trachea, bronchi, and lungs, the pharynx and esophagus, and the stomach and intestines; (b) sensory and (c) partly vaso-motor, to the same regions; (d) inhibitory influence to the heart; (e) inhibitory afferent impulses to the vaso-motor centre; (f) excito-secretory to the salivary glands; (g) excito-motor in coughing, vomiting, etc.

The 11th Nerve, or Spinal Accessory, supplies the vagus with its motor fibres by its internal branch, while its external branch supplies the sternomastoid and trapezius muscles.

The 12th Nerve, or Hypoglossal, is purely a motor nerve, and supplies the muscles connected to the hyoid bone, including those of the tongue. These muscles are the sterno-hyoid, sterno-thyroid, and the omo-hyoid through its descending branch; the thyro-hyoid through a special branch; and the genio-hyoid, stylo-glossus, hyo-glossus, genio-hyo-glossus, and lingualis through its lingual branches. When the hypoglossal nerve is irritated, these muscles twitch, and when its power is lost entirely, they are paralyzed.

CHAPTER VI

The Physiology of the Nervous System

(Functions of the Autonomic System)

In studying the functions of the autonomic nervous system it must be constantly borne in mind that it is continuous, anatomically, with the cerebrospinal system. Each ganglion of the sympathetic system is reinforced by motor and sensory filaments from the cerebrospinal system, and thus the organs under its influence are brought directly into communication with external objects and phenomena. The nerves of the autonomic system are distributed to parts over which the consciousness and the will have no control.

The properties and functions of the autonomic system have received less attention than those of the cerebrospinal system, by physiologists, on account of the difficulties attending experiments upon this system. Many facts have, however, been brought forth tending to prove that the functions of this portion of the nervous system are of the greatest importance to the general well-being of the body economy.

The vital processes in those structures supplied by the gray rami of the autonomic ganglia end as soon as the connection between the autonomic and cerebrospinal systems is abolished. But the fact that the autonomic ganglia do for a time maintain their functional power, under favorable conditions, when isolated from the cerebrospinal system, shows that its action is independent of the mind. In other words, its functional activity is automatic.

When, however, the connection between the two systems is interrupted for a prolonged period, the action of the autonomic system ceases, and disorders of various kinds become evident in those parts supplied by the portion which is thus cut off. It has been shown that a misplaced vertebra will, by exercising pressure upon the spinal nerve, break the continuity between the autonomic and cerebrospinal systems, so that impulses passing from the spinal cord will

be interrupted at this point from going onward to their destination along the autonomic nerves.

The Functions of the Autonomic Nervous System.—The autonomic system possesses the following functions:

(a) Influence on Movement and Sensibility.
(b) Influence on Nutrition.
(c) Influence on Heat Production.
(d) Influence on Metabolism.
(e) Influence on Circulation.
(f) Influence on Secretion.
(g) Influence on Excretion.
(h) Influence on other existing Action.
(i) Influence on the Special Senses.
(j) Influence on Reflex Actions.
(k) Influence on the Organs.

Influence on Movement and Sensibility.—The autonomic system is endowed with the power of conveying impulses of sensibility and of exciting motion. These properties are, however exercised differently and more slowly than by the cerebrospinal system. If, for example, we irritate a sensory nerve in the arm, the evidences of pain or reflex action are instantaneous; on the other hand irritation of the autonomic nerves and ganglia, while they give evidence of sensibility being manifested here also, do so only after a longer interval of time, and after prolonged application of the irritant. These results correspond very closely with what we know of the internal organs which are supplied almost exclusively by the autonomic system, as in the liver, lungs and kidneys. These organs, as is well known, are poorly endowed with nerves of common sensation; we are not conscious of the changes and operations going on in them. Nor are they very sensitive to pain. But they are capable of causing the perception of sensations after prolonged or unusual irritation, and become very painful when inflamed for some time. Since, as stated above, these organs are supplied almost entirely by nerve fibres from the autonomic system, these facts show that the power of sensibility is possessed by this portion of the nervous system.

There is the same peculiarity of action of the autonomic

system in its motor function. If, for example, the facial nerve is irritated, the spasms of the muscles which it controls are instantaneous, violent, and of short duration. If, however, the semilunar ganglion be irritated, it is only after a few seconds that a slow, peristaltic contraction of the intestine takes place, which continues for some time after the exciting cause has been removed.

Morbid changes taking place in the organs supplied by the autonomic system thus present a similar peculiarity in the mode of their production. If the body, for example, be exposed to cold and dampness, congestion of the kidneys, perhaps, shows itself on the following day. Inflammation of the internal organs, as is well known, is very rarely produced within twelve or twenty-four hours after the application of the exciting cause.

Influence on Nutrition.—It is essential that all parts of the body be nourished if they are to functionate normally and maintain their organic integrity. The nerves themselves must be nourished in order to retain their power of conveying impulses; in fact, malnutrition is one of the causes of disturbed nerve-action. The nutrition of every cell in the body depends upon the trophic influence of the nerve-fibres of the autonomic system.

The exact manner in which the nerves influence nutritive processes is not as yet well understood. But since nutrition is simply the building up of parts of the body, and since nutritive materials must first be digested, before they can be absorbed, conveyed to the cells and assimilated, it is readily apparent what a great number of individual processes enter into the accomplishment of that single end, which we term nutrition. Since all these processes which make the ultimate nutrition of the cells possible are governed by nerve-impulses, it cannot be questioned that the nerves control nutrition primarily. Whether or not there are special nerves which govern the nutritive process within the cell itself has been much debated, and evidence seems to support the theory that there are such nerves.

These nerves have been termed katabolic and anabolic nerves. It is supposed that every tissue is supplied with two sets of nerves, the anabolic, which subserve construc-

tive metabolism, and the katabolic nerve which stimulates destructive metabolism. The augmentor nerves are the katabolic nerves; the inhibitory nerves are the anabolic nerves. Stimulation of a katabolic nerve produces increased activity, increased metabolism, and is followed by exhaustion, and a breaking down of tissue. Such a nerve is illustrated by the autonomic augmentor nerve of the heart, on stimulation of which increased activity of the heart takes place, followed by exhaustion. Stimulation of the anabolic nerve, however, produces diminished activity, repair of tissue and building up. The cardiac vagus is an illustration of such a nerve, stimulation of which produces inhibition.

No nerve-impulses are generated without some form of stimulus acting upon the nerve-centre, and it is therefore not sufficient to dispose of the subject of trophic nerve-action by saying that there exist nerves which send out impulses which regulate this function, without giving some explanation as to where these impulses originate. It is not only necessary that sufficient nutritive materials be ingested by the body so that the balance between repair and waste may be preserved, but the use of these materials must be regulated also. The digestive, secretory, and absorptive apparati can accomplish only a certain amount of work; that is to say, can prepare for assimilation by the body only a certain amount of nutritive material for its constructive metabolism. Assuming, therefore, that a certain amount of this latent energy is available, the activities of the body must be proportioned to this energy. The nerves that govern the activity of a part must therefore regulate this activity in such a way that the output of energy will never exceed the income. If, for example, the augmentor nerve of a certain organ and the inhibitory nerve of the same organ are not acting harmoniously, the waste processes on account of excessive action may become excessive, and the nutrition of the organ will suffer because of the failure of the inhibitory nerve to suspend or retard its activity for a time, and permit the necessary reparative processes to take place during the interval of rest. Thus the nerves assume trophic functions as a result of afferent impulses reaching their centre. These impulses are generated as a result of

the stimulus created at the terminals of the nerves in the organs. These stimuli are excited by the state of exhaustion in the cells, and it is well known that exhaustion is one of the common sensations also of the cerebrospinal nerves. In the organs exhaustion is not perceived as such by the sensorium in the brain, but efferent impulses are sent out retarding the activity of the organ until sufficient rest can be secured to permit the building-up processes to occur. In this way the nutrition of all parts is maintained, namely, by regulating the activity of a part through the balanced action of the augmentor or katabolic and the inhibitory or anabolic nerves.

Influence on Heat Production.—One of the most important results of the metabolism of the tissues is the production of heat in the body. It is by this means that the temperature of the body is raised to such a point as to make life possible. The chief part of the metabolic changes in the tissues is of the nature of oxidation, since the oxygen taken into the system is ultimately combined with carbon and hydrogen and discharged as carbonic acid and water. Any changes which occur in the protoplasm of the tissues resulting in a manifestation of their functions, are attended by the evolution of heat and the production of carbonic acid and water. The more active the tissue, the greater will be the amount of heat produced, and the amount of carbonic acid and water formed. But in order that the protoplasm may perform its function the waste of its own tissue must be repaired by a due supply of good material to be changed into its own substance.

The heat-producing tissues are the following: (a) The muscles, which form such a large part of the body, and in which metabolism is particularly active, supply the principal part of the heat produced in the body. (b) The secreting glands, and especially the liver, since it is the largest, come next to the muscles as heat-producing tissue. It has been found by experiments that the blood which leaves the glands is much warmer than that which enters them. The metabolism in the glands is very active, and as we have seen, the more active the metabolism, the greater the heat produced. (c) The brain ranks next as a heat producing tissue. (d)

It must be remembered that although the above organs are the chief sources of heat in the body, that all parts contribute their share, in proportion to their activity. The blood itself is the seat of metabolism, and therefore also contributes something to the heat of the body, although a very small amount. Two other minor means of heat-production are, friction of parts of the body, as the circulation of the blood, movement of the muscles, and the ingestion of warm food and drink.

The normal temperature of the body is maintained under the varying conditions to which the body is exposed by mechanisms which permit (1) variation in the loss of heat, and (2) variations in the production of heat. Thus in normal warm-blooded animals the loss and gain of heat are so well balanced that a uniform temperature is maintained.

The loss of heat from the body is through the following avenues: (a) By radiation and conduction from its surface; (b) By continuous evaporation of water from the same part; (c) By the respiration of air some loss of heat occurs; (d) All food and drink which enters the body at a lower temperature also abstracts some of the heat of the body; (e) The urine and feces leaving the body also occasion the loss of a small amount of heat.

We have the power of heat production as well as heat dissipation. Each individual has his own coefficient of heat production. Inasmuch as the amount of heat varies with the metabolism of the tissues of the body, everything which increases that metabolism will increase the heat production. The ingestion of food increases the metabolism of the tissues, and accordingly the rate of heat production in the dog is found to be increased after a meal, and reaches its height six to nine hours after the meal. The kind of food eaten also has an effect upon the amount of heat produced, and thus when sugar is added to the meal given the dog in the experiment proving these facts, it was found that still more heat was produced. Fat is also used to increase the production of heat, as is evidenced by the large amounts of fat eaten by those who live in a cold climate to produce the requisite amount of heat. Exercise is an important measure

for the production of heat, as through it the metabolism of the muscles is increased.

The influence of the nervous system in the production of heat is very marked for upon the nervous influence depends the metabolism of the tissues. The facts which best prove this are these: First, when the nerve supply to a part is cut off, the temperature of that part soon falls below its usual degree; second, when death is caused by a serious injury of the nerve-centres, the temperature of the body rapidly falls, even though the circulation be maintained, artificial respiration performed, and all the chemical processes of the body are in operation; third, if the nerves of a limb are severed or compressed, it becomes cold; fourth, by its power of controlling the calibre of the bloodvessels the nervous system also governs the temperature of the body.

In addition to this regulation of temperature by the vasomotor influence of the nervous system, there is a separate nervous apparatus, by means of which heat production and heat loss are regulated as circumstances demand. This apparatus consists of centres which may be reflexly stimulated by afferent impulses from the skin, and which act through special efferent nerves supplying the various tissues. Any disturbance of this reflex arc will produce a temperature higher than normal. For example, a patient suffering from fever, has a body temperature several degrees higher than normal. While this increase of temperature is no doubt due to diminished loss of heat from the skin, this is far from being the only cause of the fever. The amount of oxygen taken in and the amount of carbon dioxide given out are both increased, and with this there must be increased metabolism of the tissues, and especially of the muscular tissue, because in these cases the amount of urea excreted by the urine is always increased. We are all familiar with the rapid wasting which accompanies high fevers; this means that the metabolism is not only too rapid, but also that insufficient time is had for the tissues to build up. In fever, then, there must be some interference in the ordinary channel by which the skin is able to communicate to the nervous system the necessity of an increased or a diminished production of heat in the muscles and other tissues. The

only logical place at which such an interference could occur is at the intervertebral foramina, where the nerves pass between movable bones. As a result of this, and in spite of the condition of heat of the surface of the body, the production of heat goes on at an abnormal rate, constituting what we term fever. It might be appropriately mentioned in this connection that upon this physiological fact depend the remarkable results obtained by spinal adjustment in reducing a fever.

Influence on Metabolism.—Something has already been said of the influence of the autonomic system on metabolism, in connection with its influence on nutrition. As a matter of fact, the influence of this system on metabolism is so closely interwoven with all its other functions that this action is not an isolated one, but is the prime action about which revolve all the activities of the organism, as influenced by the nervous system.

The processes of constructive and destructive metabolism are under the control of special nerve-fibres of the autonomic system. In the case of the submaxillary gland, for example, if the chorda tympani is stimulated, there is a thin, watery secretion obtained, which contains only 1 or 2 per cent of solids; if the sympathetic is stimulated in the cervical region, a thick, turbid secretion is obtained, which contains as much as 6 per cent of solids. In the former case, there is vaso-dilation, an increased flow of blood through the gland occurs, and it has a ruddy color. In the latter case, there is vaso-constriction, a diminished flow of blood occurs, and the gland is pale. Experiments have disproved the old theory that the amount of secretion depends upon the vaso-motor effect. What it does show is that the autonomic system stimulates the metabolism, as shown by the much greater richness of the secretion obtained by stimulation of the autonomic, as compared with that obtained when the chorda tympani is stimulated. This increased richness is a result of greater protoplasmic activity, which is synonymous with metabolism.

Another evidence of the effect of the autonomic system on metabolism is shown by the following experiment: When the cerebral fibres controlling the parotid gland of a dog

were stimulated, an abundant, thin, and watery saliva was obtained. Stimulation of the autonomic fibres alone, with the tympanic nerve cut, and the cerebral fibres not previously stimulated, produced no secretion at all. But by this stimulation of the autonomic a marked effect was produced on the gland; this was shown by the fact that subsequent or simultaneous stimulation of the cerebral fibres gave a secretion of saliva very different from that obtained on stimulating the cerebral fibres alone, in that it was very rich in organic constituents. When the autonomic nerve is stimulated previous to stimulating the cerebral fibres, the saliva may be ten times as rich as when only the cerebral fibres are stimulated. This shows that by stimulation of the autonomic the metabolism was so stimulated to activity that when the cerebral fibres were stimulated, the products of this increased metabolism were obtained in the saliva.

Influence on Circulation.—Perhaps the most important fact concerning the autonomic system is its influence over the vascularity and nutrition of the parts supplied by it. First of all, the division of the autonomic nerves immediately produces a vascular congestion in the corresponding parts. If the autonomic be divided in the neck, in the rabbit, a vascular congestion of all parts of the head, on the corresponding side immediately follows. This congestion is most evident in the thin and transparent ears, which on the affected side become very red, due to the turgid condition of the bloodvessels. This condition lasts for a considerable time, and even for a longer time when the cervical ganglion is extirpated, or a portion of the nerve cut out, than when its filaments have been simply divided. It finally disappears when the separated filaments have been re-united and their functional activity restored.

The vascular congestion thus produced by the division of the autonomic nerve is accompanied by three important phenomena, all intimately connected with each other.

First, the amount of blood in a part is increased, and the rapidity of its movement is accelerated. The congestion is not due to venous obstruction, but all the vessels are dilated, an increased amount of blood passes through the capillaries and returns by the veins in greater abundance than before.

Second, there is a marked elevation in the temperature of the affected part. This increase of temperature may be felt by touching the ear of the rabbit, and even the skin of the corresponding side of the head. Measured by the thermometer, it has been found by Bernard to reach, in some cases, 8° or 9° F. This is due to the increased quantity of blood, which carries added heat to the parts.

Third, the color of the venous blood in the affected part becomes brighter and more ruddy. This effect is also due to the increased rapidity of the circulation. As the arterial blood is deprived of its oxygen and darkened in color by the changes of nutrition which usually take place in the tissues, if the rapidity of the circulation be suddenly increased, a certain part of the blood escapes deoxidation, and the change in color, from arterial to venous, is incomplete. Summed up, therefore, the blood returns by the veins of the affected part in greater abundance, at a higher temperature, and of a more ruddy color, than that on the unaffected side.

Now, it is found that if that portion of the divided nerve which is in connection with the affected tissue is irritated by electricity, all the above effects rapidly disappear; the blood-vessels of the ear and side of the head contract to their previous size, the quantity of blood circulating through the tissues is diminished, the temperature of the parts is reduced to a corresponding degree, and the blood in the veins returns to its ordinary dark color.

The variations in the rapidity of the circulation dependent on the autonomic nerve were shown by Bernard in the following experiment. The upper part of a rabbit's ear is cut off so that the blood may escape in jets. The force and height of the jets having been observed, the autonomic nerve is then divided, and at once the blood escapes from the ear in greater abundance; if then the galvanic current is applied to the proximal end of the cut nerve, the escape of blood gradually ceases; as soon as the galvanic current is removed, the flow of blood again increases. A similar influence is exerted by the autonomic nerve upon the circulation in the limbs. If the lumbar nerves of one side be divided, in a dog, within the spinal canal, paralysis and anaesthesia of the corresponding limb follow, but there is no

change in its temperature or vascularity. But if the lumbar portion of the autonomic be divided, without disturbing the spinal nerves, increased circulation and temperature are at once evident, without any loss of motion or sensibility. Exsection of the first thoracic ganglion produces similar effects in the upper extremity; and these effects disappear when the galvanic current is applied to the upper end of the divided nerve.

The vascularity of all parts, therefore, as well as their functional activity depends upon the action of the nervous system. The autonomic nerves accompany the blood-vessels to their minutest ramifications. These autonomic fibres act by causing a contraction of the muscular coat of the blood-vessels and thus regulate the passage of blood through them. These nerves are termed, accordingly, vaso-motor nerves, and they do not differ from the pilo-motor and secretory nerves except in the nature of the structure in which they terminate. They are of two kinds, according to their function, namely: vaso-constrictor and vaso-dilator.

Influence on Secretion.—Numerous experiments which have been made tend to prove that special secretory nerves exist. These nerves govern the activity of the secretory structures of the body, assisted by trophic nerves. A detailed account of them is scarcely appropriate in this place, since a thorough understanding of them can be obtained by reference to any work on physiology.

The various secretory organs contain special secreting cells, which form the secretion peculiar to that special organ. The products of secretion are not derived from the blood through osmosis as was formerly supposed, because the secreted material contains ingredients which are never found in the blood. Thus the saliva contains pytalin, the gastric juice contains pepsin, etc. The characteristic ingredients of the various glands are formed by the catalytic transformation of their organic constituents; these new substances formed by the gland cells, together with the saline and watery constituents derived from the blood constitute the secreted fluid. A true secretion, therefore, is produced only in its own particular gland, and cannot be formed elsewhere, since the glandular cells of that organ

are the only ones capable of producing its most characteristic ingredient.

The process of secretion depends upon the peculiar anatomical and chemical constitution of the glandular tissue and its secreting cells. These cells have the property of taking from the blood certain inorganic and saline substances, and of producing by chemical metamorphosis certain peculiar animal matters from their own tissue. These substances are then mingled together, dissolved in the watery fluids of the secretion, and discharged simultaneously by the excretory duct.

This process is controlled by the autonomic and cerebrospinal systems, and is entirely involuntary. It depends for its occurrence upon the excitation of the secretory centre, by afferent impulses, which reflexly affect the fibres which control the secretory cells of a particular gland. For example, the smell of food reflexly causes a free flow of saliva; the ingestion of food then produces the secretion of gastric juice. A constant flow of efferent impulses, such as that which maintains the muscles in a state of continuous contraction, may also govern the secretory activities of certain glands, as those having an internal secretion, namely the thyroid, spleen, etc.

Any interference with the conductivity of the autonomic nerves changes the character of the secretion and interferes with the functional activity of the organ which depends for its action upon the materials which it secretes. The autonomic nerves influence secretion by their vaso-dilatory action upon the blood, and also by their trophic action. Thus, when the autonomic fibres are stimulated, previous to stimulation of the cerebral fibres controlling the parotid gland of a dog, a rich salivary secretion is obtained, while stimulation of the cerebral fibres alone gives an abundant thin and watery secretion. The autonomic system alone does not govern secretion, but the part which it takes in this function is exceedingly important, as demonstrated by clinical results obtained in the various conditions dependent upon faulty secretion.

Influence on Excretion.—In order to understand the nature of this process we must bear in mind that all the

component parts of a living organism are in a state of constant change. Every animal absorbs constantly substances which it converts into the natural ingredients of the organized tissues. At the same time there goes on in the same tissues an incessant process of waste and decomposition. The products of this destructive process are destined to be discharged from the body and are known as excrementitious substances. These substances are conveyed by the blood to certain excretory organs, which discharge them from the body. This entire process is known as excretion.

The importance of this process to the maintenance of life is readily shown by the injurious effects which follow upon its disturbance. If the discharge of the excrementitious substances be in any way impeded or stopped, they accumulate in the blood and tissues. In consequence of this retention and accumulation, they become poisonous, and rapidly produce a disturbance of the vital functions. Their influence is particularly exerted upon the nervous system, producing various forms of irritability, disturbance of the special senses, deliriums, insensibility, coma, and even death.

The most important avenues for the discharge from the body of these poisonous substances are the bowels, kidneys, skin, and lungs. The nerve supply, both cerebrospinal and autonomic, of these organs will be given in detail farther on. Suffice it to say at this point that derangement of the nerve-supply to these eliminative organs is followed by a train of diseased conditions, the number and seriousness of which is stupendous. These conditions have as their basis that very common condition known as autointoxication, and it is scarcely necessary to go into detail regarding the vast number of affections of diverse kinds which may be traced to a perverted function of the excretory organs. What a variety of conditions result from constipation, for example, is well known; again, the great number of diseases resulting from faulty action of the kidneys needs no explanation; then, the train of diseases following depleted excretory activity of the skin are very well understood; lastly, deficient oxygenation of the blood as produced by respiratory incapacity, is also well known to be the cause of many and varied disorders.

The importance of proper excretory action of the parts to which this function is peculiar assumes tremendous proportions. These functions are intimately dependent upon a free and untrammeled action of the nervous system. Any obstruction to the passage of the efferent impulses along the cerebrospinal and autonomic nerve-fibres at once produces deficient excretion from the organs which are deprived of these nerve-impulses. The profuse perspiration following stimulation of the cervical autonomic ganglia illustrates the marked influence it has upon the action of the excretory apparatus of the skin. Like results follow adjustment of misplaced vertebrae when the other excretory organs are affected.

Influence on Other Existing Action.—All the active tissues of the body may be influenced by their nerves in two opposite ways. That is, stimulation may increase or decrease their activity. Thus the functional activity of the glands, nerve-centres and muscles can be so varied. The nerves which cause increased action are known as augmentor, while those that produce decreased action are called inhibitory nerves. They are distinct from each other anatomically, except in the central nervous system.

It is questionable whether there exists a special class of inhibitory nerves but there must certainly be a different dendritic pathway for the impulses causing inhibition. Whatever nerves do subserve this function, their importance is manifest, for they control the balanced activity of all parts. Since their action is involuntary, it may be safely assumed that it is the peculiar office of the autonomic system to influence existing action, in connection with the cerebrospinal nerves to the part involved.

The general bearing of these facts is of the greatest importance. As has been pointed out by Hughlings-Jackson, damage of any sort to a portion of the nervous system may, in the simplest case, decrease the activity of the group of neurons controlled by the damaged part by cutting off the stimulating impulses from them. On the other hand, a fact which is often overlooked, it may cause them to become abnormally active, by the stoppage of some impulses which exert an inhibitory effect.

Influence on the Special Senses.—In the cranium, the autonomic system has a very close and important connection with the exercise of the special senses. This is especially well illustrated in the case of the eye, by its influence on the expansion and contraction of the pupil.

The ophthalmic ganglion sends off a number of ciliary nerves, which are distributed to the iris. As we have seen, it is connected with the remaining autonomic ganglia in the head, and receives, beside, a sensory root from the ophthalmic branch of the fifth cranial nerve, and a motor root from the third cranial nerve. The reflex action by which the pupil contracts when a strong light falls upon the retina, and expands when the amount of light is diminished, takes place, accordingly, through this ganglion. The impression on the retina is conveyed by the optic nerve to the tubercula quadrigemina, and then reflected outward by the motor oculi. The efferent impulse is not transmitted directly to the iris by the last-named nerve, but passes first to the ophthalmic ganglion, and thence to its destination, by the ciliary nerves.

The reflex movements of the iris are somewhat sluggish, which indicates the intervention of the autonomic. The changes in the size of the pupil do not occur immediately with the varying amounts of light, but require an appreciable interval of time. For example, if we pass from a dark apartment into the brilliant sunshine, we are at once conscious of a painful sensation in the eyes, which lasts for a considerable time; this results from the inability of the pupil to contract with sufficient rapidity to shut out the excessive amount of light.

The reflex movements of the iris derive their original stimulus from the motor oculi nerve. This nerve, however, will not act without the assistance of the autonomic. Any break in the connection of the autonomic with the motor oculi, therefore, prevents the latter from functioning. Thus if the autonomic in the neck, in a cat, be divided, the pupil of the corresponding eye becomes strongly and permanently contracted. In addition to this, the upper and lower eyelids and the nictitating membrane are also drawn partially over the cornea, and assist in excluding the light. Secondly, di-

vision of the motor oculi, alone, in the cat, does not cause dilatation of the pupil. The fact that the motor oculi and the facial nerves control the external muscles of the eye, ear, and nose, but that contraction of those muscles follows division of the autonomic, shows the intimate dependence of these cranial nerves upon the integrity of the autonomic.

Similarly, in spasms of the eyelids, no actual lesion of the motor oculi can be found, but irritation of the superior cervical ganglion of the gangliated cord is present, and is responsible for this condition. It is for this reason that adjustment of a misplaced cervical vertebra, especially the fourth, or one of the upper dorsal region, at once stops such spasms.

In the olfactory apparatus, the external muscles, namely the compressors and elevators of the alae nasi, are supplied by filaments from the facial nerve. Their action serves to permit the entrance of odoriferous particles when desirable, and to exclude those which are not desired. The deep muscles, namely the levators and depressors of the velum palati and the azygos uvulae, are supplied by the spheno-palatine ganglion, and accomplish a similar purpose with the external muscles; they tend to close the posterior nares, and their action is involuntary.

The auditory apparatus has two similar sets of muscles, similarly supplied. The external muscles are supplied by branches from the facial nerve, and their action is voluntary, namely movement of the external ear. The deep-seated set are the muscles of the middle ear. It must be remembered that sounds are transmitted from the external to the middle ear through the tympanic membrane, which vibrates, like the head of a drum, on receiving sonorous impulses from without. Accordingly the ear-drum may be made more or less sensitive to sonorous impressions by varying its degree of tension or relaxation. This condition, as is well known, is regulated by the action of the two muscles of the middle ear, viz., the tensor tympani and the stapedius. The tensor tympani is supplied by filaments from the otic ganglion of the autonomic. By its contraction the membrane is rendered tense, and on the relaxation of this muscle, the membrane returns to its former condition.

This action is involuntary. But the stapedius is supplied by a minute filament from the facial nerve, and it is probable that this arrangement enables us to a degree of voluntary action, as in listening intently to distant or faint sounds.

In all the above instances, the reflex action of the drum which takes place originates from a sensation which is conveyed inward to the cerebrospinal centres, and is then transmitted outward to its destination through the medium of one of the autonomic ganglia.

Influence on Reflex Action.—The influence of the autonomic system on reflex actions is exceedingly important. There are three kinds of reflex action, taking place wholly or partly through the autonomic system, which may be observed to occur in the living body.

First, reflex actions taking place from the internal organs, through the autonomic and cerebrospinal systems to the voluntary muscles and the sensory surfaces. Thus, the convulsions of young children are often due to the presence of undigested food in the intestinal canal. Attacks of indigestion often produce temporary amaurosis, double vision, strabismus, and even hemiplegia. Nausea and vomiting are prominent symptoms of the second and third months of pregnancy, induced reflexly by the peculiar condition of the uterine mucous membrane.

Secondly, reflex actions taking place from the sensory surfaces, through the autonomic and cerebrospinal systems, to the involuntary muscles and secreting glands. Thus exposure to cold and wet will often cause diarrhea. Mental and moral impressions, conveyed through the special senses, will affect the action of the heart, and disturb the processes of digestion and secretion. Terror, or intense interest in something, will cause the pupil to become dilated. Disagreeable sights or odors may bring on or stop menstruation or induce premature labor.

Thirdly, reflex actions taking place through the autonomic system, from one part of the internal organs to another. Thus, the contact of food with mucous membrane of the small intestines excites a peristaltic movement of their muscular walls. The mutual action of the digestive, urinary, and internal generative organs upon each other

takes place through the medium of the autonomic ganglia and their nerves. The variations of the capillary circulation in the abdominal viscera, corresponding with their state of activity or rest, are produced by the same mechanism.

These phenomena are not accompanied by any consciousness on the part of the individual, nor by any apparent intervention of the cerebrospinal system.

Influence on the Organs.—The autonomic system has an action entirely separate from any connection with the cerebrospinal system in those organs in which terminal ganglia are located. For example, the influence of the cardiac autonomic nerves on the heart, and of the splanchnics on the stomach. Other instances of this influence also exist, and will be considered at proper length in the section dealing with the nerve-supply of the various organs of the body.

SECTION THREE

Innervation

CHAPTER I

The Innervation of the Structures of the Cranium, Face and Neck

A ready familiarity with the nerve-supply of every system, organ, and part of the body is essential to a thorough understanding of the underlying principles of chiropractic. It is also necessary from the view-point of diagnosis and adjustment of diseased conditions by these methods.

The connection between the spinal and cranial nerves and those of the autonomic system has already been explained. What remains to be considered, therefore, is the connection between the nerves of each spinal segment and the respective organs which they supply.

Since the nervous system is continuous throughout its entire course, it follows that each system, organ, and part of the body derives its nerve-supply through the medium of the spinal cord and the spinal nerves which, given off from it, emerge through the intervertebral foramina. It is at this point that the reflex arc is situated by which the body is kept in harmony with the external influences which affect it. Any interference with the proper action of this arc will cause disharmony and disease.

As has been previously shown, vertebral subluxations will, by inhibiting the irritability and conductivity of the nerves at this point, deprive the corresponding parts of the body of the nerve-impulses necessary to their fuctional activity and organic integrity. It is for this reason that we will consider in this connection the parts of the body supplied by the nerve from each segment of the spine, and all its ramifications.

The Innervation of the Scalp.—The innervation of the scalp is derived from the following nerves:

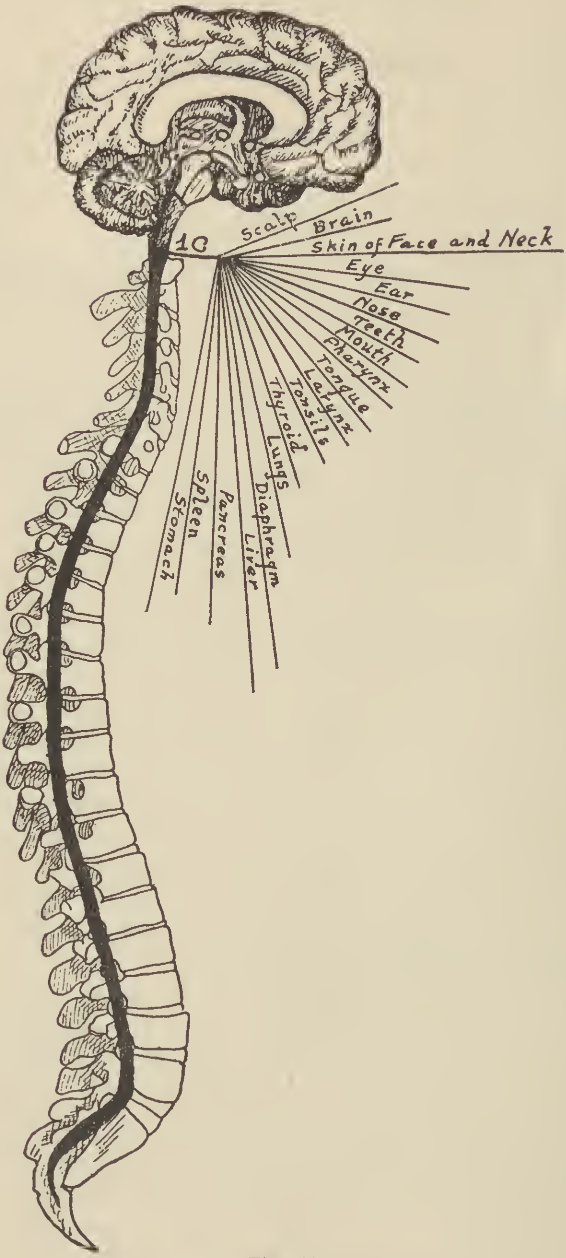

Fig. 11

Parts Influenced by the First Cervical Nerve.

1. The posterior auricular, which is a branch of the facial which communicates with the autonomic on the middle meningeal artery by the external superficial petrosal nerve; this in turn communicates with the superior cervical ganglion.

2. The great auricular nerves, the branches of origin of which communicate with the second and third pairs of cervical nerves, and send branches to the region of the scalp about the ears.

3. The suboccipital nerves, which are the first pair of spinal nerves and emerge from the vertebral canal through the posterior condyloid notches between the occipital bone and the posterior arch of the atlas on each side. These nerves supply a greater portion of the scalp than any others, sending branches to the occipital region, the vertex and the forehead.

4. The occipitalis major nerve, which is the internal branch of the posterior division of the second cervical nerve. In its upward course it is joined by a filament from the posterior division of the third cervical nerve, and on the back part of the head divides into two branches which supply the integument of the scalp as far forward as the vertex.

5. The occipitalis minor, which arises from the second cervical nerve, and sometimes also the third. It extends upward along the side of the back of the head, and supplies the integument behind the ear. Here it communicates with the occipitalis major, the great auricular, and the posterior auricular branch of the facial. It gives off an auricular branch which supplies the integument of the upper and back part of the auricle.

6. The third occipital nerve, which arises from the internal or cutaneous branch of the posterior division of the third cervical nerve, and which supplies the skin on the lower and back part of the head.

7. The fourth pair of cervical nerves also influence the scalp, by reason of their control of the circulation. They form the greater part of the phrenic nerve which innervates the diaphragm and lungs, and governs their movements. In this manner, the middle cervical nerves by affecting the circulation of the thorax, influence indirectly the circulation of the head. Failure of proper action of the diaphragm and

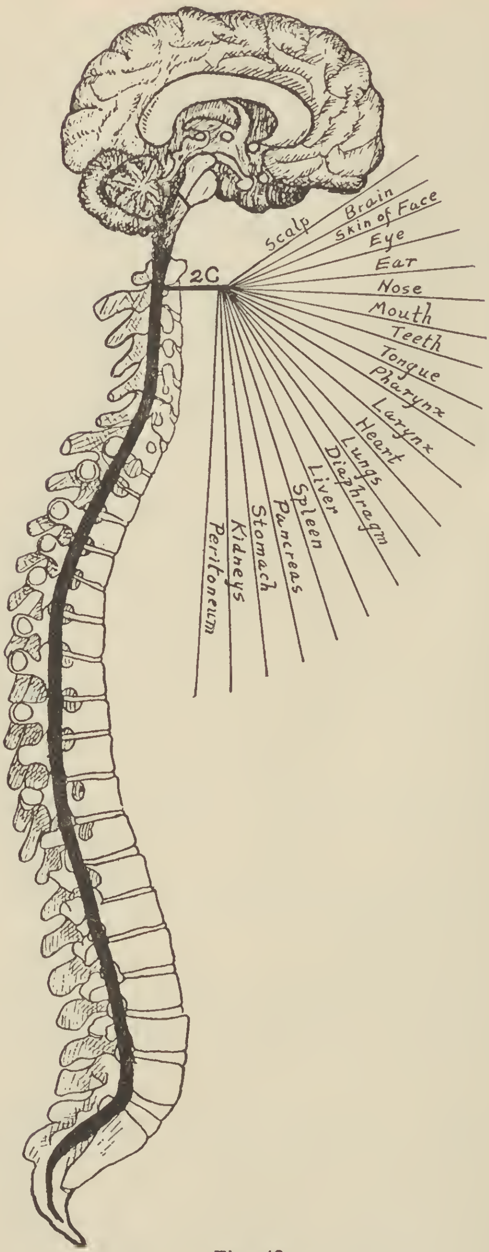

Fig. 12

Parts Influenced by the Second Cervical Nerve.

lungs, by diminishing the blood in those parts, will result in an excess of blood in the brain. On the contrary, a free action of the diaphragm and lungs will relieve congestion of the brain.

8. The scalp is also indirectly affected by the spinal segments down to the tenth segment. This is due to the influence of these nerves upon the glands of the skin. All the nerves, and especially the tenth dorsal, affect the skin of the corresponding region of the body.

The Innervation of the Face and Neck.—The innervation of the integument of the face and neck is derived principally from the cervical plexus and the cranial nerves. The dorsal nerves also indirectly influence these parts by their control of the circulation. Specifically the face and neck are innervated by the following nerves:

1. The trigeminal nerves, through the ophthalmic, superior maxillary, and inferior maxillary nerves supply the integument of the face and the deeper structures. The Gasserian ganglion from which the three branches of this nerve are derived communicates with the carotid plexus of the autonomic. The ophthalmic nerve communicates with the cavernous plexus of the autonomic, the third and sixth nerves and occasionally with the fourth nerve. By means of this connection with the superior cervical ganglion of the autonomic the structures supplied by the trigeminal nerve may be influenced by adjustment of the upper four cervical vertebrae.

2. The facial nerves, which supply the remaining portions of the skin of the face and the muscles of expression. This nerve communicates, through the geniculate ganglion, with the autonomic on the middle meningeal artery by the external superficial petrosal nerve. The structures which it supplies are thus also influenced by adjustment of the upper four cervical vertebrae.

3. The first, second, third, and fourth cervical nerves, which give off branches to form the cervical plexus which is distributed to the integument and muscles of the face and neck.

4. The first six thoracic nerves send white rami communicantes to the superior cervical ganglion of the auto-

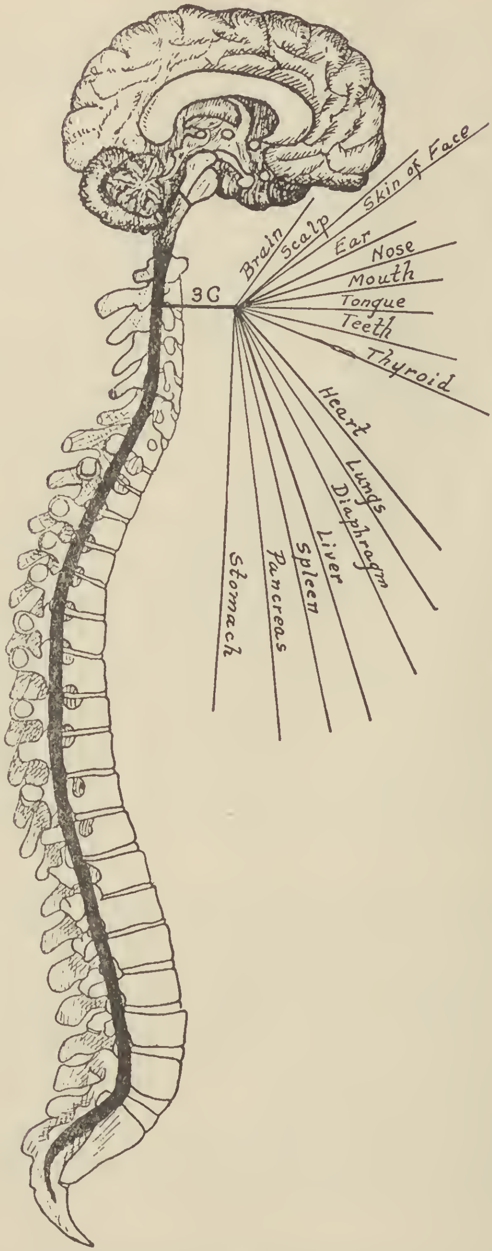

Fig. 13

Parts Influenced by the Third Cervical Nerve.

nomic, which through its various communications influences the integument of the face and neck.

5. The tenth thoracic nerves by reason of their influence upon the function of the skin, affect the integument of the face and neck. These nerves also have a decided influence upon the action of the kidneys, and by increasing the elimination of fluids through this channel, will diminish the elimination through the skin.

The Innervation of the Brain.—Various nerves are distributed to the substance of the brain and its meninges, and govern its function, metabolism and the circulation of the blood through it. The brain is accordingly innervated by the following nerves:

1. The dura mater is supplied by filaments from the Gasserian ganglion, from the ophthalmic, superior maxillary, inferior maxillary, vagus, and hypoglossal nerves, and from the autonomic.

The arachnoid is supplied by a rich plexus derived from the motor division of the fifth, the facial, and the spinal accessory nerves.

The pia mater is supplied by branches from the autonomic, and from the third, fifth, sixth, seventh, ninth, tenth, and eleventh cranial nerves.

Since the above nerves all communicate with the superior cervical ganglion of the gangliated cord, and this in turn with the upper four spinal nerves, subluxations of the upper four cervical vertebrae will affect the meninges of the brain.

2. The fourth cervical nerves by their influence upon the circulation of the blood in the thorax indirectly influence the cerebral blood-supply, and are therefore considered as having an influence upon the brain.

3. The suboccipital nerves affect the meninges by giving off branches which assist in the formation of the recurrent nerve to the tentorium.

4. The lower cervical nerves, by their influence upon the respiratory movements, indirectly influence the circulation in the brain. The expansion of the thorax in inspiration increases the blood-supply to this region, and thus decreases the blood-supply to the cranium. Deficient respiratory

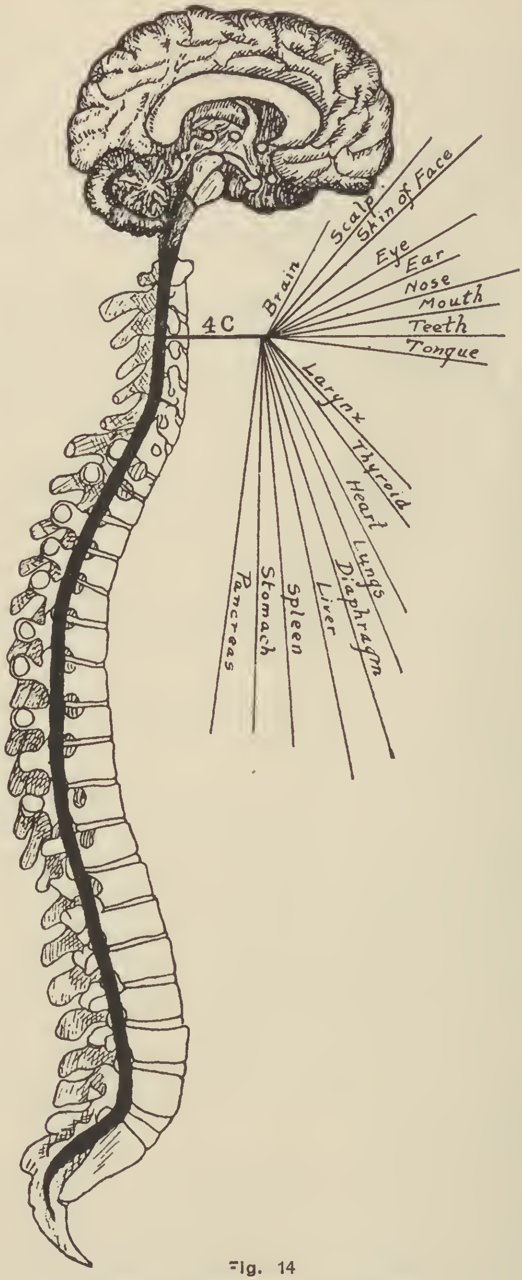

Fig. 14
Parts Influenced by the Fourth Cervical Nerve.

movements diminish the blood-supply to the thorax, and therefore cause a congestion in the brain.

5. The upper thoracic nerves, by sending white rami communicantes to the superior cervical ganglion which communicates with all the cranial nerves, have an influence upon the functional activity of the brain. From the superior cervical ganglion impulses are transmitted by the gray rami to the cranial nerves, the rami then accompanying the cranial nerves from their origin outward to their entire distribution.

6. The lower thoracic nerves, by reason of their communication with the phrenic nerves, have an indirect, but decided, influence upon the circulation of the brain.

The Innervation of the Eye.—The innervation of the eye both direct and indirect, is of the greatest importance, since clinical experience bears out the fact that, although, anatomically the connection between certain spinal nerves with the optic nerve cannot be exactly demonstrated, yet their influence on the functional activity of the structures of the orbit cannot be denied. The eyes are innervated by the following nerves:

1. The optic nerves, which pass directly from the cortical surface of the occipital lobe of the cerebrum to the retina of the eye, have a direct and decided influence upon the eye. These nerves, from their mode of development and their structure, must be considered as direct prolongations of the brain substance, rather than as an ordinary cerebrospinal nerve. As the optic nerves pass from the brain they receive sheaths from the three cerebral membranes—a perineural sheath from the pia mater, an intermediate sheath from the arachnoid, and an outer sheath from the dura mater, which is also connected with the periosteum as it passes through the optic foramen.

2. The suboccipital nerves, by communicating with, and assisting in the formation of the recurrent nerve to the tentorium, influence the nutrition of the cortical surfaces of the occipital lobes, and consequently of the optic nerves.

3. The fourth cervical nerves have the most marked influence upon the function of the optic nerves, and also influence the contraction and dilatation of the pupil. Subluxations affecting these nerves have been known to result

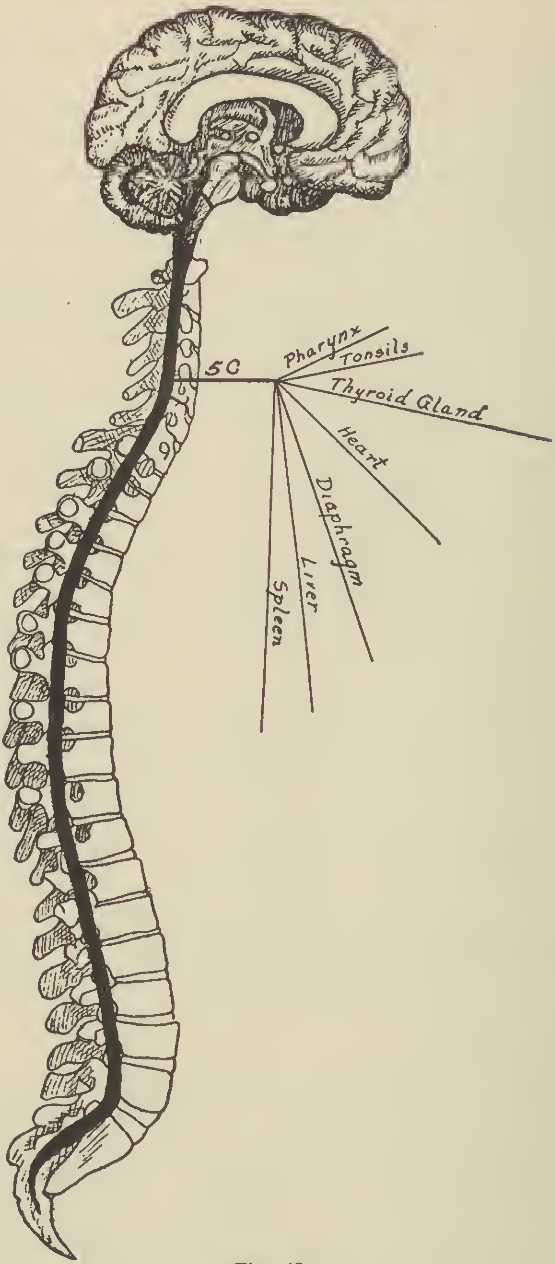

Fig. 15

Parts Influenced by the Fifth Cervical Nerve.

in loss of vision, and cases are on record where their adjustment has restored vision.

4. The first, second and third dorsal nerves have an influence on the action of the ciliary muscles of the eye, by reason of their communication with the ciliary nerves. Their impingement may result in failure of the power of accommodation of the eye, and thus cause disturbances of vision. Spasms of the eye-lids may be relieved instantly by adjustment of the upper thoracic vertebrae.

5. The fifth pair of dorsal spinal nerves influence the eye-balls by reason of their communication with the superior cervical ganglion, which communicates with the cranial nerves. This connection is established by the communication of the carotid plexus with the Gasserian ganglion, and with the sixth nerve; and of the cavernous plexus with the third, the fourth, the ophthalmic division of the fifth, the sixth, and the ophthalmic ganglion. In this manner there is a direct communication of the fifth dorsal spinal nerves with the nerves to the eye-ball, and adjustment of the fifth dorsal vertebra relieves many abnormal conditions of the eye.

6. The tenth pair of dorsal spinal nerves have an influence upon the eyes. This has been rather obscure anatomically, but clinical evidence bears out the connection. We know that the tenth dorsal nerves markedly influence the kidneys, and clinically we very often meet with visual troubles in various diseases of the kidneys. The only connection that exists between the tenth pair of thoracic nerves with the optic nerves is through the communication of the former with the terminal fibres of the phrenic, which in turn is derived partly from the fourth cervical nerve, which we have seen has so powerful an influence upon vision.

7. The first and second lumbar nerves also have a somewhat obsure yet decided influence upon the eyes. The reader must constantly bear in mind that clinical phenomena are very often met with for which there is no positive explanation, yet which are sufficient to prove that a connection exists between certain nerves, even though they cannot be traced anatomically.

The Innervation of the Ear.—The innervation of the ear is derived from the following nerves:

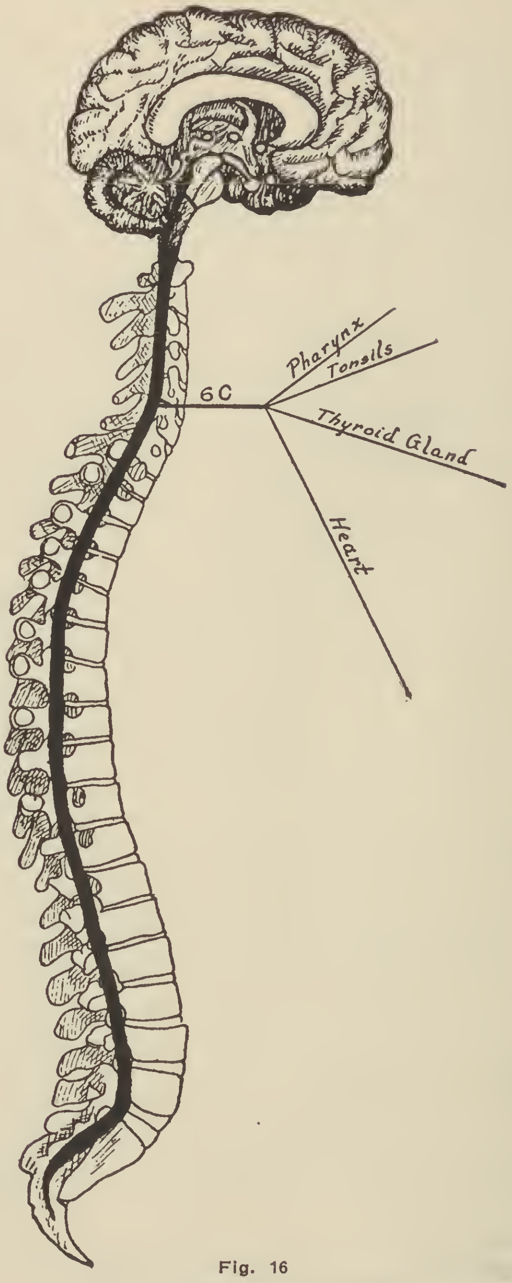

Fig. 16

Parts Influenced by the Sixth Cervical Nerve.

1. The auditory nerve, which receives a branch from the geniculate ganglion, which communicates with the superior cervical ganglion through the external petrosal nerve. It also connects with the upper thoracic spinal nerves through the connection of the continuous ascending fibres of white rami communicantes with the superior cervical ganglion. Hence it is that the upper cervical and upper dorsal segments influence to such a marked degree the ear.

2. The first four cervical spinal nerves unite with and influence the ganglia which supply the auditory apparatus. Through the medium of the recurrent nerve to the tentorium they also affect the circulation of the brain, and consequently influence also the auditory centres in the cerebrum.

3. The upper five pairs of dorsal spinal nerves influence the ear by reason of their connection with the superior cervical ganglion. The superior cervical ganglion communicates with the eighth cranial nerve, and for this reason subluxations in the upper cervical or upper dorsal region produce disturbances in reference to the ear. The test for determining whether deafness is due to a lesion of the auditory nerve itself or to a lesion of the auditory apparatus is to place a vibrating tuning fork on the head; in cases where the auditory apparatus is at fault the vibrations will be heard, but not when there is a lesion of the auditory nerve. A serious lesion of the auditory nerve proper necessarily produces permanent deafness, but functional disturbances due to subluxations in the upper cervical or upper dorsal regions, as well as disturbances of the auditory apparatus respond very readily to spinal adjustment.

The Innervation of the Nose.—The innervation of the nasal chambers is derived from the following nerves:

1. The olfactory nerve, the special nerve of the sense of smell, is distributed to the olfactory region of the nasal cavities. This nerve communicates with the superior cervical ganglion of the autonomic, and is therefore influenced by lesions in the upper cervical region.

2. The nasal nerve, a branch of the ophthalmic division of the fifth cranial nerve, distributes filaments to the fore part of the septum and the outer wall of the nasal fossae. This nerve is also influenced by lesions of the upper four

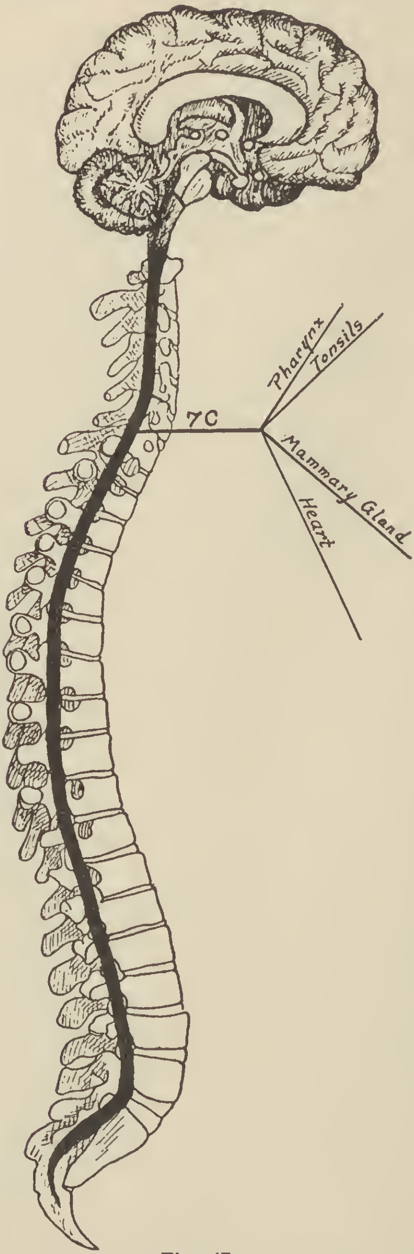

Fig. 17

Parts Influenced by the Seventh Cervical Nerve.

cervical vertebrae since the Gasserian ganglion communicates with the carotid plexus of the superior cervical ganglion, while the ophthalmic division of the fifth cranial nerve communicates with the cavernous plexus.

3. The vidian nerve, which supplies the upper and back part of the septum and the superior spongy bone, communicates through the superior cervical ganglion with the upper four spinal nerves.

4. The naso-palatine nerve, a branch of the superior division of the fifth cranial nerve, communicates with the superior cervical ganglion through the connection of the Gasserian ganglion with the carotid plexus.

5. The third cervical spinal nerve, by its connection with the superior cervical ganglion, communicates with the fifth cranial nerve, and thus becomes the most direct source of innervation to the nose.

6. The fourth cervical spinal nerve, for the same reason that the third spinal nerve affects the nose, also influences the nasal cavities directly.

7. The fourth and fifth dorsal spinal nerves, by their connection with the superior cervical ganglion of the autonomic, have an indirect influence upon the nasal cavities.

8. The tenth pair of thoracic spinal nerves have a very great influence on the action of the skin. A subluxation causing interference with these nerves will, therefore, markedly affect the Schneiderian membrane of the nose.

The Innervation of the Pharynx.—The innervation of the pharynx is derived from the following nerves:

1. The first and second cervical spinal nerves, by reason of their connection with the vagus, have a direct influence upon the pharynx.

2. The fifth, sixth and seventh cervical spinal nerves have a direct influence on the pharynx.

3. The upper dorsal spinal nerves have an indirect influence upon the pharynx, through their connection with the superior cervical ganglion.

4. The pharyngeal nerves, which are one of the internal branches of the superior cervical ganglion of the autonomic, pass to the side of the pharynx, where they join with branches from the glosso-pharyngeal, vagus, and external

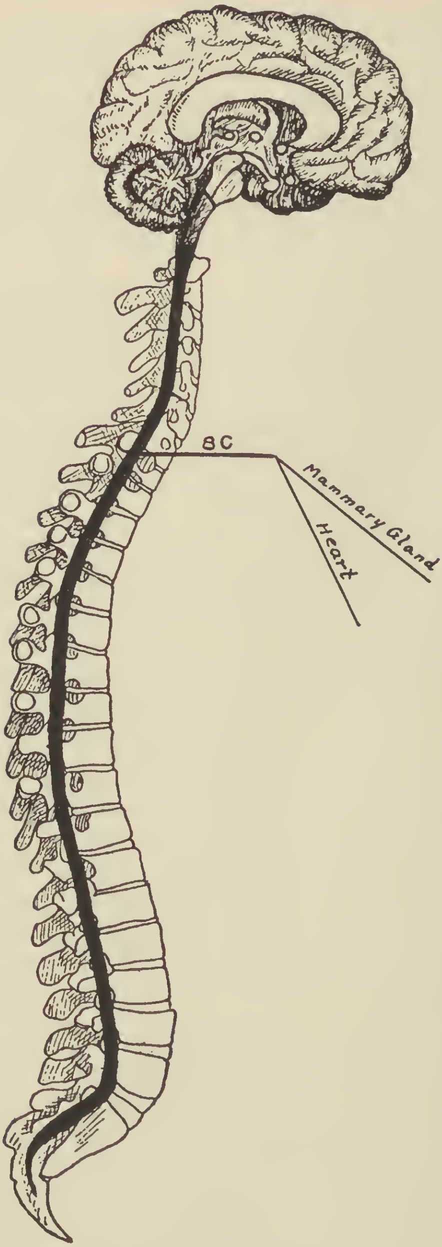

Fig. 18

Parts Influenced by the Eighth Cervical Nerve.

laryngeal nerves to form the pharyngeal plexus. The superior cervical ganglion communicating with the upper four spinal nerves, any impingement of these nerves will interfere with the proper innervation of the larynx, which is very quickly corrected by adjustment of the misplaced vertebrae.

5. The pharyngeal branch from Meckel's ganglion, which communicates with the superior cervical ganglion of the autonomic, also influences the pharynx.

6. The pharyngeal branches of the glosso-pharyngeal nerve unite with the pharyngeal branches of the vagus and autonomic nerves to form the pharyngeal plexus, branches from which perforate the muscular coat of the pharynx to supply the muscles and mucous membrane.

7. The pharyngeal branch of the vagus, the principal motor nerve of the pharynx, arises from the inferior ganglion of the vagus.

8. The lower dorsal spinal nerves supply the pharynx by reason of their connection with the phrenic and vagus.

The Innervation of the Tonsils.—The innervation of the tonsils is derived from the following nerves:

1. The upper cervical spinal nerves, especially the first and second, influence the tonsils through their connection with the superior cervical ganglion of the autonomic which communicates with the vagus, the tonsillar branch of the glosso-pharyngeal, the pharyngeal plexus, Meckel's ganglion which gives off the middle or external palatine nerve to the tonsil, and the posterior palatine nerve which joins with the middle palatine to form the plexus around the tonsil.

2. The fifth, sixth, and seventh cervical spinal nerves have a decided influence upon the tonsils, as shown by clinical results obtained by adjustment of vertebrae which impinge these nerves.

3. The fifth thoracic spinal nerves, by their connection with the superior cervical ganglion indirectly influence the tonsils.

The Innervation of the Larynx.—The innervation of the larynx is derived from the following nerves:

1. The first cervical spinal nerve, through its connection with the vagus and its communication with the superior

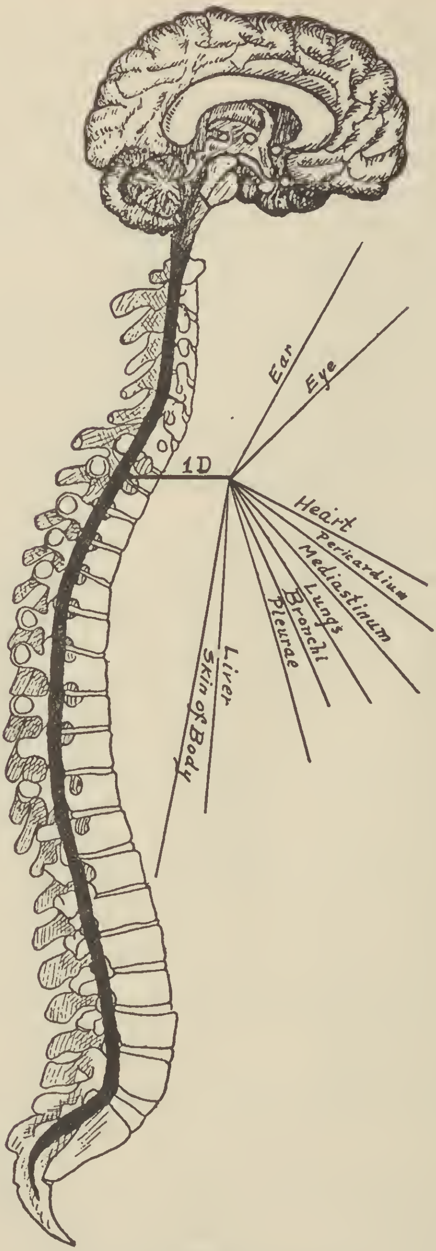

Fig. 19

Parts Influenced by the First Dorsal Nerve.

cervical ganglion of the autonomic. The vagus in turn gives off the following branches: The superior laryngeal, which is the sensory nerve of the larynx, and which arises from the inferior ganglion of the vagus; it consists principally of filaments from the spinal accessory, and divides into two branches, the internal and external laryngeal. The inferior or recurrent laryngeal nerve, also a branch of the vagus, is the motor nerve of the larynx, and unites with the cardiac branch from the vagus and the autonomic.

The autonomic laryngeal nerve is one of the internal branches of the superior cervical ganglion, and communicates with the superior laryngeal nerve and its branches.

2. The second pair of cervical spinal nerves also influence the larynx by reason of their communication with the superior cervical ganglion of the autonomic, and by sending filaments to the terminal ganglia by which these structures are innervated.

3. The fourth pair of cervical nerves also communicate with the terminal ganglia of this region, and with the superior cervical ganglion of the autonomic.

4. The fifth pair of dorsal spinal nerves, through their connection with the superior cervical ganglion have a marked influence upon the larynx and the throat as clinical results frequently demonstrate.

The Innervation of the Tongue.—The innervation of the tongue is derived from the following nerves:

1. The hypoglossal and glosso-pharyngeal nerves are the two cranial nerves which directly supply the tongue.

2. The first and second cervical spinal nerves influence the tongue by reason of the fibres which they send to the hypoglossal and glosso-pharyngeal nerves. Also by reason of their communication with the superior cervical ganglion of the autonomic, which in turn communicates with the hypoglossal nerve by external branches, and with the glosso-pharyngeal by a separate filament which joins the petrosal ganglion of that nerve.

3. The upper four cervical spinal nerves influence the tongue, by reason of their connection with the superior cervical ganglion of the autonomic which in turn communicates with the cranial nerves, as follows: The lingual branch of

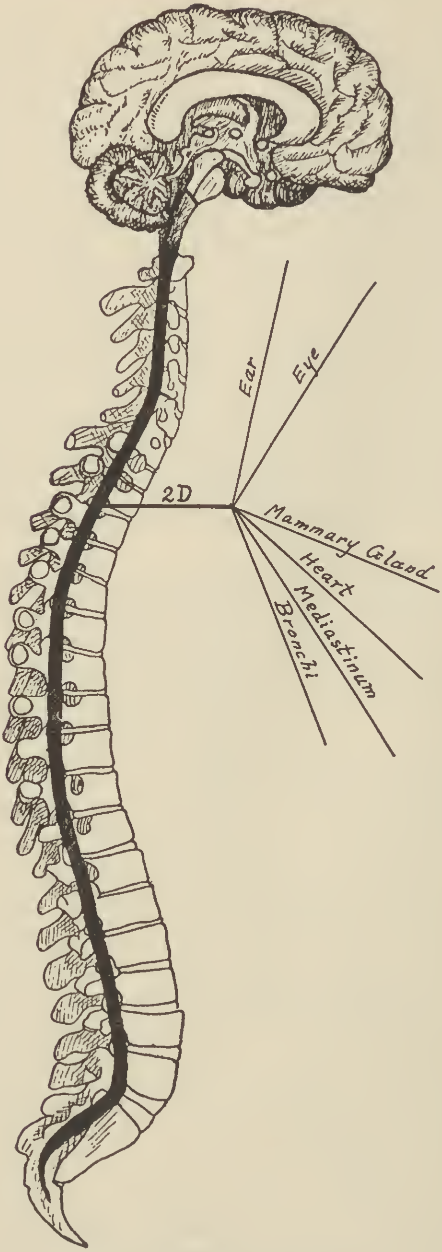

Fig. 20
Parts Influenced by the Second Dorsal Nerve.

the fifth, which supplies ordinary sensibility to the anterior two-thirds of the tongue; the chorda tympani, in the sheath of the lingual, which confers the sense of taste on the anterior two-thirds of the tongue; the lingual branch of the glosso-pharyngeal, which supplies sensation and the sense of taste to the base and sides of the tongue; the superior laryngeal branches of the tenth, which distribute fine branches to the root of the tongue near the epiglottis.

Autonomic fibres pass to the tongue from the nervi molles on the lingual and other arteries supplying the tongue.

4. The fifth, sixth, and seventh cervical nerves supply the tongue through their connection with the autonomic branches to the facial nerve.

5. The fifth thoracic spinal nerve has a marked effect upon the tongue, by reason of its connection with the superior cervical ganglion. This in turn communicates with the terminal ganglia of the tongue.

The Innervation of the Teeth and Oral Cavity.—The innervation of the teeth and oral cavity is derived from the following nerves:

1. The upper four cervical nerves, by reason of their communication with the superior cervical ganglion, which unites with the trifacial nerve. The third and fourth cervical spinal nerves especially communicate with the three divisions of the fifth cranial nerve, and adjustment of the vertebrae causing impingement of these nerves has a marked effect upon the teeth and mouth.

3. The fifth thoracic spinal nerves affect the teeth and gums, as well as the other structures of the head and neck, by reason of their communication with the superior cervical ganglion.

The Innervation of the Thyroid Gland.—The innervation of the thyroid gland is derived from the following nerves:

1. The upper four cervical spinal nerves influence the thyroid gland through their connection with the superior cervical ganglion which sends a branch of communication to the vagus, branches of which form the pharyngeal plexus which supplies the thyroid gland.

2. The fifth and sixth cervical nerves influence the

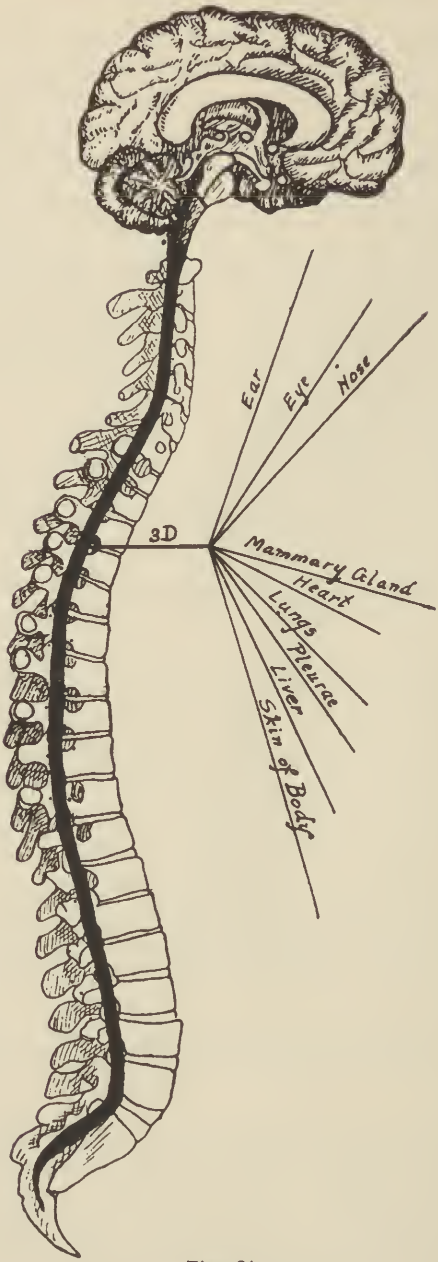

Fig. 21

Parts Influenced by the Third Dorsal Nerve.

thyroid gland by reason of their communication with the middle cervical ganglion of the autonomic. The thyroid branches of this ganglion directly supply the thyroid gland; they accompany the inferior thyroid artery to the thyroid gland. They communicate on the artery with the cardiac nerves, and in the gland with the recurrent and external laryngeal nerves.

3. The seventh and eighth cervical nerves also influence the thyroid, since they join the inferior cervical ganglion which sends fibres to the middle cervical ganglion, and with the cardiac and recurrent laryngeal nerves.

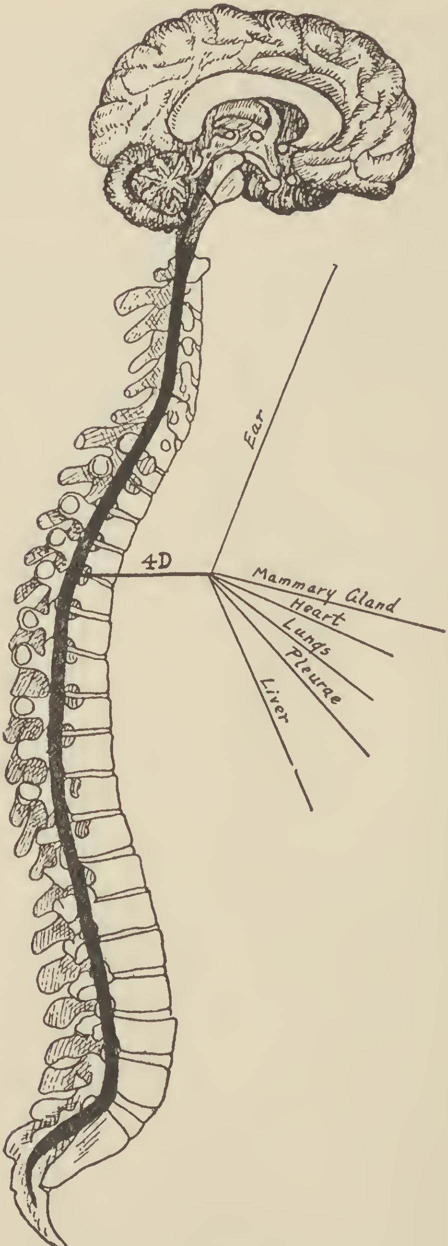

Fig. 22

Parts Influenced by the Fourth Dorsal Nerve.

CHAPTER II

The Innervation of the Organs of the Thorax

The Innervation of the Mammary Gland.—The innervation of the mammary gland is derived from the following nerves:

1. The second, third, fourth, fifth, and sixth dorsal spinal nerves through their anterior branches, named the upper or pectoral intercostal nerves. These nerves give off the lateral cutaneous, the anterior branches of which supply the mammary gland.

2. The upper thoracic nerves further influence the mammary gland through the medium of the gray rami communicantes which join the intercostal nerves.

3. The lower cervical nerves as well as the upper dorsal also influence the mammary gland through the internal and external intercostal branches of the brachial plexus.

The Innervation of the Heart.—The innervation of the heart is derived from the following nerves:

1. The first, second, third, and fourth cervical spinal nerves influence the heart as a result of their following connections: They communicate with the superior cervical ganglion which sends a branch to the vagus; the branches of the vagus which supply the heart are the cervical cardiac branches which arise from it at the upper and lower part of the neck; the superior branch connects with the cardiac autonomic branches; the inferior branch communicates with the superficial cardiac plexus. The thoracic cardiac branches arise from the trunk of the vagus and end in the deep cardiac plexus.

The superior cardiac is one of the internal branches of the superior cervical ganglion; it receives a filament from the cord of communication between the upper and middle cervical ganglia.

The deep cardiac plexus is formed by the cardiac nerves derived from the cervical ganglia and the cardiac branches of the recurrent laryngeal and vagus.

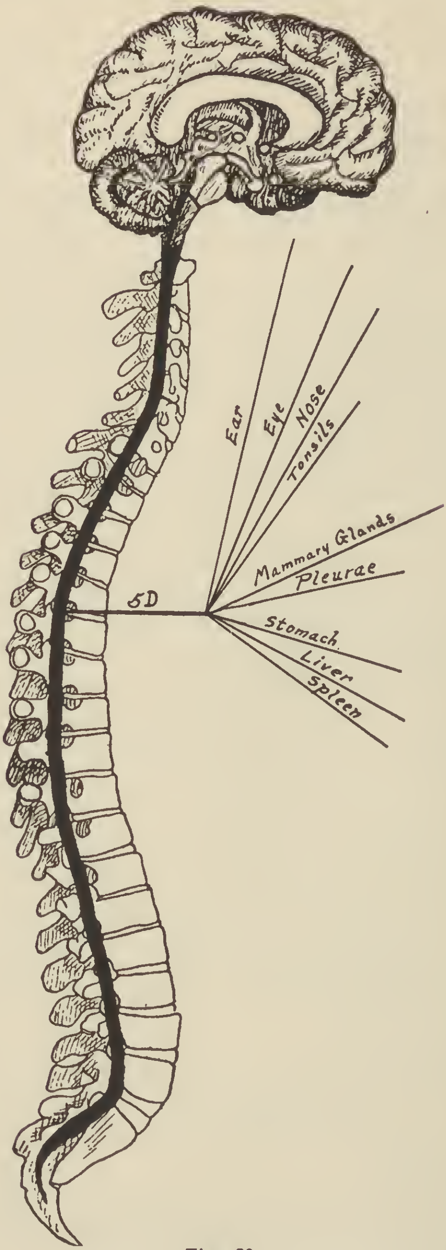

Fig. 23

Parts Influenced by the Fifth Dorsal Nerve.

The superficial cardiac plexus is formed by the left superior cardiac nerve, the left (and occasionally the right) inferior cervical cardiac branches of the vagus, and filaments from the deep cardiac plexus. A small ganglion, the cardiac ganglion of Wrisberg, is sometimes found connected with these nerves at their point of junction. These plexuses supply the surface and substance of the heart.

The superior cardiac nerve, above referred to, divides into two branches: the right superior cardiac nerve at about the middle of the neck receives filaments from the external laryngeal nerve; lower down, one or two twigs from the vagus; and as it enters the thorax it is joined by a filament from the recurrent laryngeal. Filaments from this nerve communicate with the thyroid branches from the middle cervical ganglion.

The left superior cardiac nerve, in the chest, runs by the side of the left common carotid artery and in front of the arch of the aorta to the superficial cardiac plexus, but occasionally it passes behind the aorta and ends in the deep cardiac plexus.

2. The fifth and sixth cervical spinal nerves influence the heart by their connection with the middle cervical ganglion of the autonomic. This ganglion gives off the middle cardiac nerve, which divides into two branches. The one on the right side receives a few branches from the recurrent laryngeal nerve, and joins the right side of the deep cardiac plexus; in the neck it communicates with the superior cardiac and recurrent laryngeal nerves. On the left side the middle cardiac nerve joins the left side of the deep cardiac plexus.

3. The seventh and eight cervical spinal nerves influence the heart by their connection with the inferior cervical ganglion of the autonomic, which gives off the inferior cardiac nerve. This nerve communicates freely with the recurrent laryngeal nerve and the middle cardiac nerve.

4. The third, fourth and fifth cervical spinal nerves, in addition to the above mentioned connections with cardiac nerves, also give off the phrenic nerves which supply the pericardium, and which assist in the formation of the cardiac plexus.

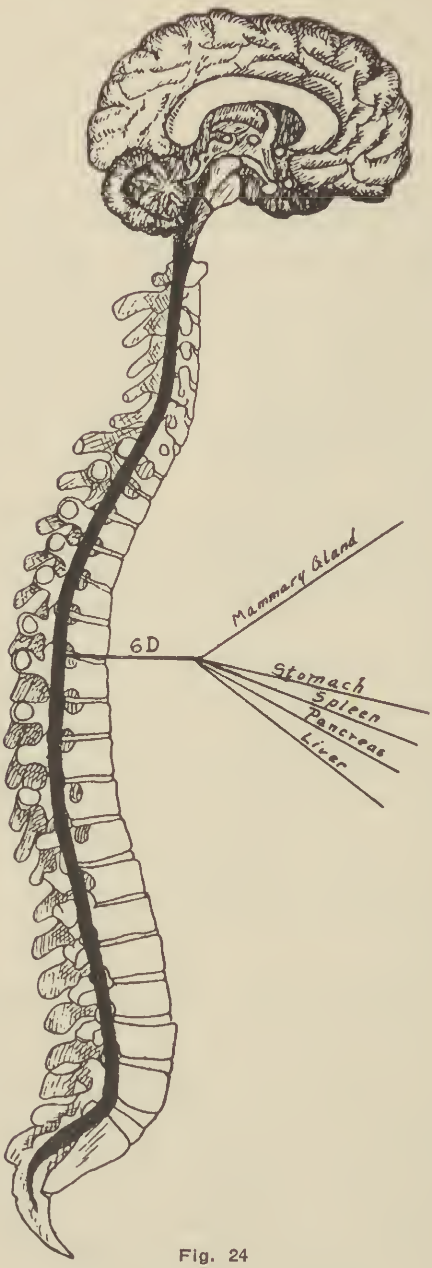

Fig. 24

Parts Influenced by the Sixth Dorsal Nerve.

5. The upper dorsal spinal nerves, especially the second, have a powerful influence upon the action of the heart.

6. The fourth thoracic spinal nerves have a vaso-motor and inhibitory influence upon the heart. The action of the heart may be restored to normal by removing pressure upon this nerve, as well as by percussion over the spinous processes of the first and second thoracic vertebrae. This influence of the fourth thoracic nerve upon the action of the heart may be readily demonstrated by using the above described methods when it will be found that the number of heart-beats may be reduced from ninety per minute to seventy in a few minutes.

7. The lower thoracic spinal nerves, through their communication with the terminal fibres of the phrenic nerves, exert an indirect influence on the heart action.

The Innervation of the Lungs.—The innervation of the lungs is derived from the following nerves:

1. The first cervical spinal nerves influence the lungs by sending a branch to the vagus, which supplies the lungs through the anterior and posterior pulmonary nerves.

2. The upper four cervical nerves influence the lungs through their connection with the superior cervical ganglion of the autonomic, which communicates with the vagus. The anterior pulmonary branches of the vagus are distributed to the anterior aspect of the root of the lungs. They join with the filaments from the autonomic to form the anterior pulmonary plexus. The posterior pulmonary branches are distributed on the posterior aspect of the root of the lungs. Branches from both these plexuses accompany the bronchial tubes, and have small ganglia along their course.

3. The fourth cervical spinal nerves have an especial influence upon the lungs. These nerves give origin to the phrenic nerves, which have a direct effect on the lungs by reason of their distribution to the pleurae, pericardium and diaphragm. As previously explained, these nerves, by governing the movements of the thoracic viscera, influence to a marked degree the cerebral circulation.

4. The first to fourth thoracic spinal nerves affect the lungs by their connection with the first four thoracic ganglia of the gangliated cord, which communicate with the

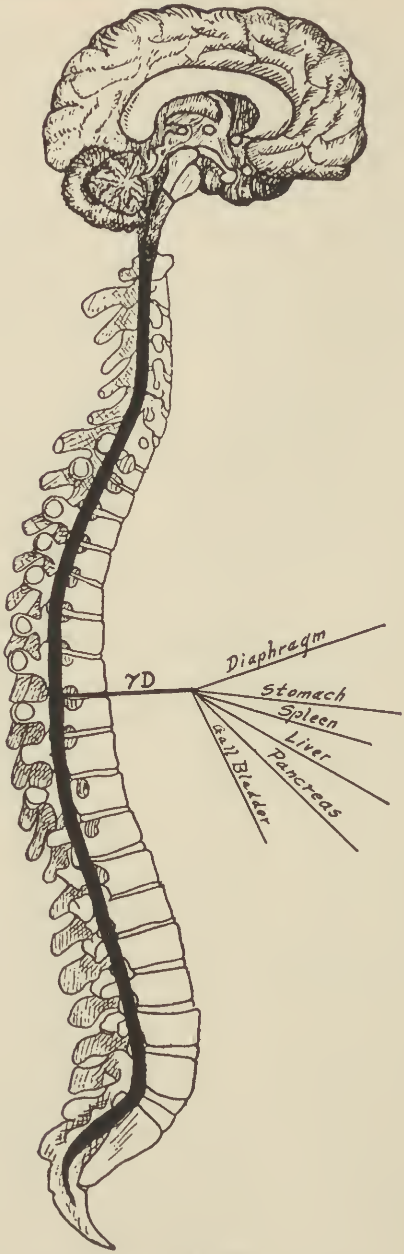

Fig. 25

Parts Influenced by the Seventh Dorsal Nerve.

posterior pulmonary branch of the vagus to form the pulmonary plexus. The third and fourth ganglia especially, and the first and second more rarely have this connection.

5. The third thoracic nerves, however, have the most marked influence upon the lungs. They supply the entire extent of the pleurae and the upper lobe of both lungs.

6. Various other spinal nerves indirectly influence the lungs by their connection with nerves influencing other organs, the proper function of which has much to do with the condition of the lungs or their restoration to a normal state when they are diseased.

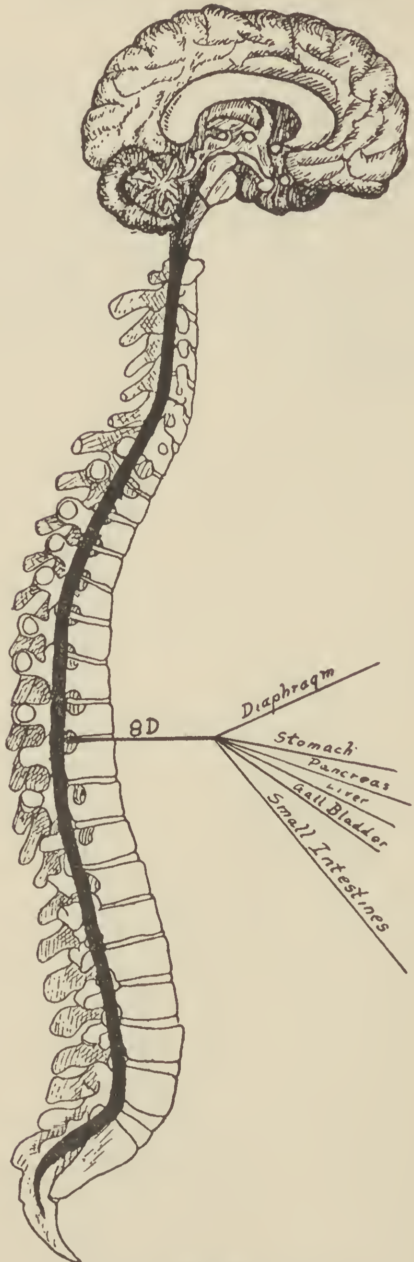

Fig. 26
Parts Influenced by the Eighth
Dorsal Nerve.

CHAPTER III

The Innervation of the Organs of the Abdomen

The Innervation of the Peritoneum.—The innervation of the peritoneum is derived from practically the same nerves that supply the large and small intestines (q. v.). Its upper portions are supplied by the vagus and phrenic nerves, while in the lower portions of the abdomen it receives its innervation from the splanchnic nerves and white rami from the lower dorsal and upper lumbar nerves.

The Innervation of the Diaphragm.—The innervation of the diaphragm is derived from the following nerves:

1. The first to fourth cervical spinal nerves influence the diaphragm by reason of their communication with the vagus nerve, which assists in the formation of the phrenic or diaphragmatic plexus, and also sends fibres directly to the diaphragm.

2. The third, fourth and fifth cervical nerves by entering into the formation of the phrenic nerves have an important effect upon the diaphragm.

3. The middle thoracic nerves influence the diaphragm by their communication with the fifth to tenth thoracic autonomic ganglia, branches from which form the great splanchnic nerves which terminate in the semilunar plexus, of which the phrenic or diaphragmatic plexus is a prolongation.

4. The seventh to eleventh thoracic nerves whose anterior divisions, namely the lower or abdominal intercostal nerves, also supply the diaphragm, have a direct influence on this structure.

5. The tenth and eleventh thoracic nerves further influence the diaphragm by reason of their connection with the corresponding ganglia which give off the lesser splanchnic nerve which joins the solar plexus, and, in the chest, communicates with the great splanchnic nerve.

The Innervation of the Liver.—The innervation of the liver is very similar to that of the stomach. The various

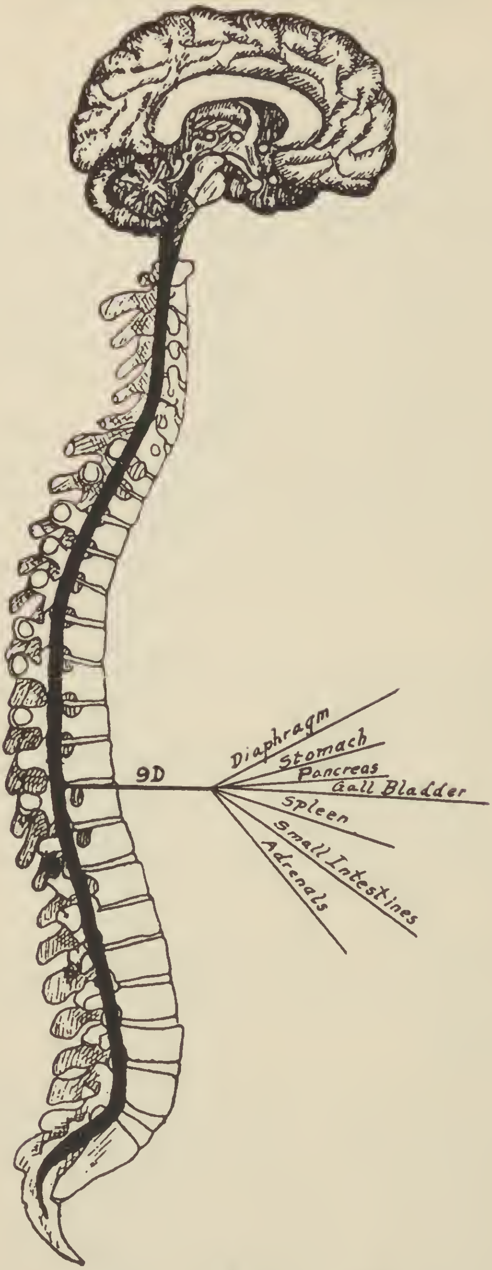

Fig. 27

Parts Influenced by the Ninth Dorsal Nerve.

segments of the spinal column affect the liver in practically the same manner that they do the stomach. The innervation of the liver is accordingly derived from the following nerves:

1. The upper cervical nerves influence the liver by their connection with the vagus nerve which sends a filament of communication to the hepatic plexus.

2. The third, fourth and fifth cervical nerves also influence the liver by reason of their formation of the phrenic nerves which send a filament to the hepatic plexus.

3. The middle thoracic nerves influence the liver in the same manner and for the same reason that they influence the stomach. From this region emanate the splanchnic nerves, which are derived from the fifth or sixth to the ninth of tenth thoracic ganglia, and which have a direct influence upon the liver.

The Innervation of the Spleen.—The innervation of the spleen is derived from the following nerves:

1. The upper four cervical nerves influence the spleen through their connection with the vagus nerve, in the same manner that these nerves influence the liver and stomach.

2. The third, fourth and fifth cervical nerves also influence the spleen by reason of their entering into the formation of the phrenic nerves.

3. The middle thoracic spinal nerves influence the spleen through their connection with the corresponding thoracic ganglia of the gangliated cord, which latter communicate with the splanchnic nerves to the semilunar ganglion of the solar plexus. The left semilunar ganglion, together with branches from the celiac plexus and the right vagus nerve, form the splenic plexus, which accompanies the splenic artery to the substance of the spleen.

The sixth dorsal spinal nerve has the most marked influence upon the spleen.

The Innervation of the Pancreas.—The innervation of the pancreas is derived from the following nerves:

1. The upper four cervical spinal nerves through their connection with the vagus nerve have an indirect influence on the pancreas.

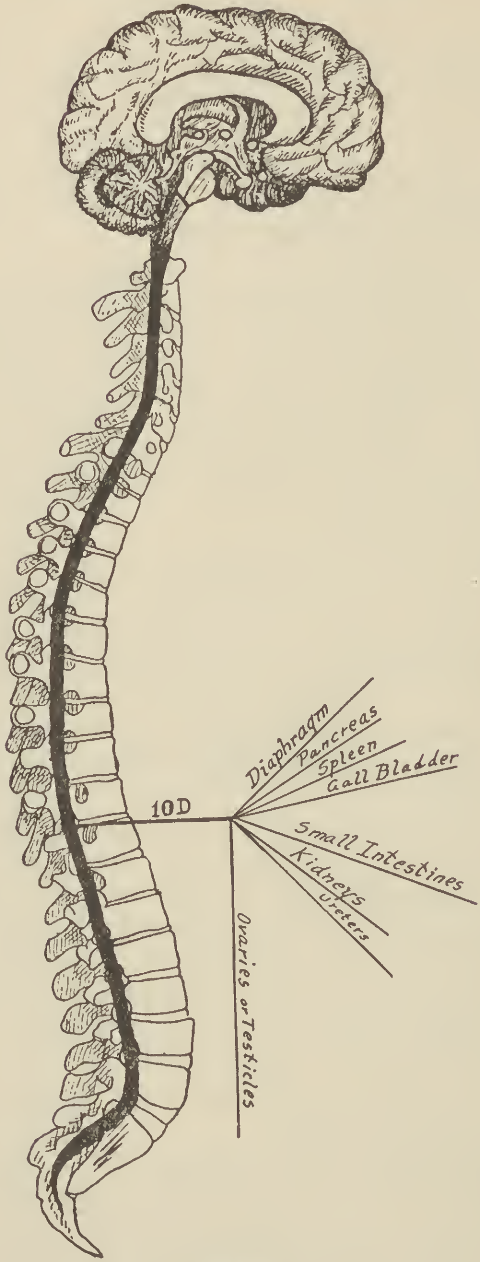

Fig. 28

Parts Influenced by the Tenth Dorsal Nerve.

2. The middle cervical nerves, especially the fourth, by forming the phrenics also influence the pancreas.

3. The middle thoracic spinal nerves through their connection with the semilunar ganglia and solar plexus have the greatest effect on the pancreas and adrenals. The eighth dorsal spinal nerves have the most marked influence on the pancreas. Filaments from the splenic plexus form the pancreatic plexus and it is the eighth thoracic nerve which enters most largely into the formation of this portion of the splenic plexus.

The Innervation of the Stomach.—The innervation of the stomach is derived from the following nerves:

1. The vagus by its terminal branches supplies the stomach; the one on the right being distributed to the back part, and the left to the front part of the organ. Its communication with spinal nerves through the rami communicantes in various segments of the spine makes possible the influence of the function of the stomach by adjustment of the vertebrae in various regions of the vertebral column.

The splanchnic nerves also influence the stomach, through their termination in the solar plexus. Since these nerves communicate with the thoracic ganglia, and these in turn with the thoracic spinal nerves, the stomach may be affected more or less directly and markedly by subluxations in this region of the spine.

A great number of autonomic branches also influence the stomach, and their connection with the spinal nerves makes impingement of such spinal nerves an important factor in the production of various gastric disorders.

2. The upper cervical spinal nerves influence the stomach and other organs of the abdomen by their communication with the vagus. Any impingement of these nerves will, therefore, interfere with the action of those parts supplied by the vagus.

3. The fourth cervical spinal nerves, by forming in connection with the third and fifth cervicals the phrenic nerves, influence the stomach. The phrenics enter into the formation of the solar plexus.

4. The fifth, sixth and seventh pairs of thoracic spinal nerves have the most marked influence on the stomach.

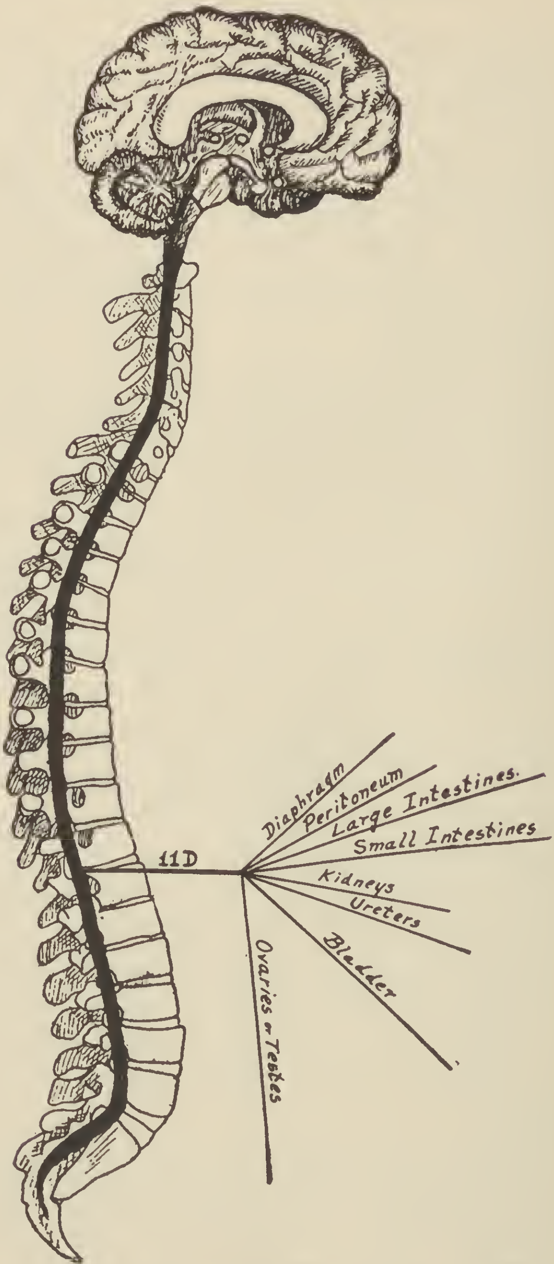

Fig. 29

Parts Influenced by the Eleventh Dorsal Nerve.

These nerves form the great splanchnic nerves, which terminate in the semilunar ganglion, a portion of the solar plexus.

5. The tenth and eleventh thoracic spinal nerves have an influence on the stomach. These nerves communicate with the corresponding ganglia of the gangliated cord, which in turn form the lesser splanchnic nerves which, together with a filament from the right vagus nerve, communicate with the celiac plexus. This plexus is a direct continuation of the solar plexus, and gives off the gastric plexus which accompanies the gastric artery along the lesser curvature of the stomach and joins with branches from the left vagus nerve.

6. The first and second lumbar nerves, by communicating with the terminal fibres of the vagus nerve, directly influence the stomach. It is for this reason that we find nausea and vomiting in pelvic disorders and especially in pregnancy.

The Innervation of the Large Intestine.—The nerves that supply the large intestine are derived from the plexuses of the autonomic nerve around the branches of the superior and inferior mesenteric arteries that are distributed to the large intestine. They are distributed in a similar way to those in the small intestine.

The innervation of the large intestines is derived from the following nerves:

1. The vagus nerve influences the large intestine by its communication with the celiac and splenic plexuses. The celiac plexus is a continuation of the solar plexus, while the superior mesenteric and aortic plexuses which supply the large intestines are also derived from the solar plexus.

2. The lower thoracic nerves influence the large intestine through the splanchnic nerves, and through the descending fibres of white rami communicantes. These nerves further influence the large intestine in the following manner: The splanchnic nerves terminate in the solar plexus and semilunar ganglia which give rise to the aortic plexus, from which is derived the inferior mesenteric plexus. This plexus surrounds the inferior mesenteric artery, and subdivides into a number of secondary plexuses, which are dis-

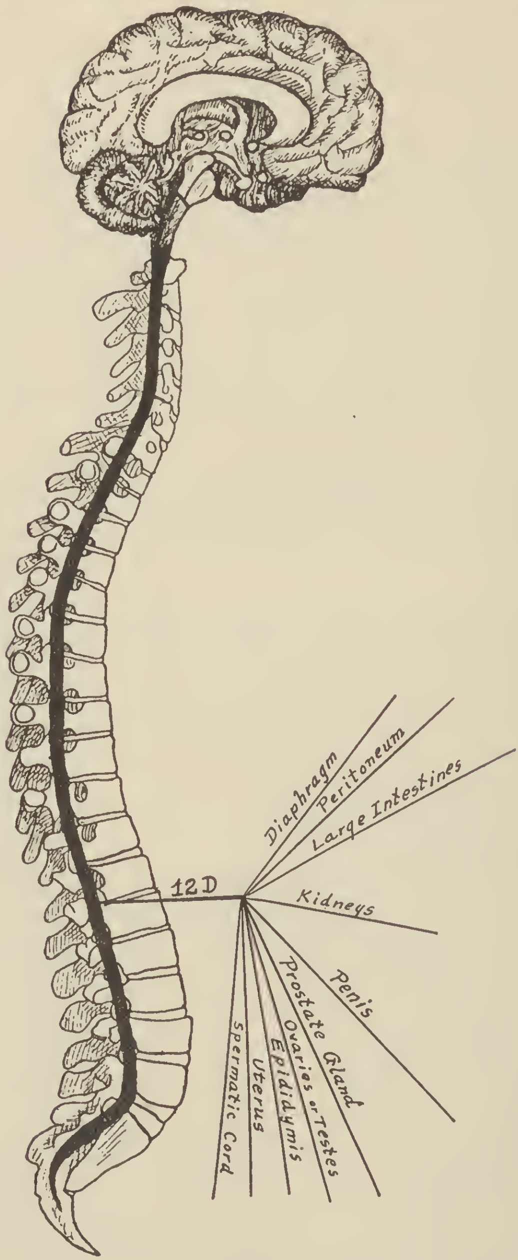

Fig. 30

Parts Supplied by the Twelfth Dorsal Nerve.

tributed to all the parts supplied by the artery, namely the left colic and sigmoid plexuses which supply the descending and sigmoid flexure of the colon; and the superior hemorrhoidal plexus, which supplies the upper part of the rectum. The ileo-colic, right colic, and middle colic branches of the superior mesenteric plexus supply the corresponding parts of the large intestine.

3. The upper lumbar nerves, especially the second, influence the large intestines through their connection with the ganglia which communicate with the aortic plexus.

The innervation of the appendix is practically identical to that of the large intestine, of which it is a part. Thus we find that adjustment of the second lumbar vertebra will in the great majority of instances relieve appendicitis.

5. In addition to the innervation of the upper part of the rectum mentioned above, the lower portion is supplied by the inferior hemorrhoidal plexus which arises from the pelvic plexus. This plexus communicates with the superior hemorrhoidal plexus.

The fourth, and especially the fifth lumbar spinal nerves indirectly influence the rectum through their connection with the pelvic plexus which supplies the rectum.

The Innervation of the Small Intestine.—The nerves of the small intestine are derived from the plexuses of autonomic nerves around the superior mesenteric artery. From this source they run to a plexus of nerves and ganglia situated between the circular and longitudinal muscular fibres, named Auerbach's plexus, from which the nervous branches are distributed to the muscular coats of the intestine. From this plexus a secondary plexus is derived, named the plexus of Meissner, which is formed by branches which have perforated the circular muscular fibres. This plexus lies between the muscular and mucous coats of the intestine. It is also gangliated, and from it the terminal fibres pass to the muscularis mucosae and to the mucous membrane and villi.

The following are the spinal segments which influence the innervation of the intestine:

1. Since the vagus nerve supplies the small intestines the upper cervical spinal nerves which communicate with this

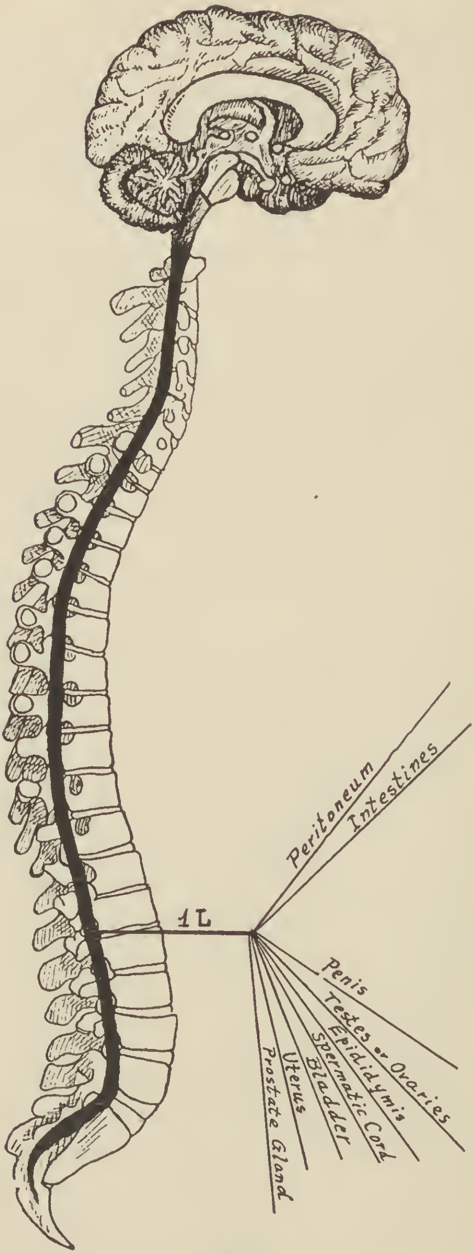

Fig. 31

Parts Influenced by the First Lumbar Nerve.

nerve through the medium of the autonomic have an influence on the intestines.

2. The phrenic nerves also supply the small intestines, and being formed by the third, fourth and fifth cervical spinal nerves, these nerves influence the small intestines.

3. The three splanchnic nerves supply the small intestine, and since they communicate with the thoracic spinal nerves through the autonomic ganglia and rami communicantes, these spinal nerves have a decided influence upon the small intestine.

The great splanchnic nerve is formed by branches from the thoracic ganglia between the fifth and sixth and the ninth or tenth, but the fibres in the upper roots may be traced upward in the gangliated cord as high as the first or second thoracic ganglia. It terminates in the semilunar ganglion of the solar plexus.

The lesser splanchnic nerve is formed by filaments from the tenth and eleventh ganglia, and from the cord between them. It joins the solar plexus, and communicates in the chest with the great splanchnic nerve.

The smallest splanchnic nerve arises from the twelfth thoracic ganglion and terminates in the solar and renal plexuses. It sometimes communicates with the lesser splanchnic nerve.

4. The lumbar nerves have some influence upon the small intestines.

The Innervation of the Kidneys.—The nerves of the kidney, although small, are about fifteen in number. They have small ganglia developed upon them. They are derived from the renal plexus, which is formed by branches from the solar plexus, the lower and outer part of the semilunar ganglion, the aortic plexus, and from the lesser and smallest splanchnic nerves. They communicate with the spermatic plexus, and this fact probably explains the occurrence of pain in the testicle in affections of the kidney.

The following are the spinal nerves which influence the kidneys:

1. The first and second cervical spinal nerves influence the kidneys by reason of their communication with the vagus nerve which supplies the kidneys indirectly.

Fig. 32

Parts Influenced by the Second Lumbar Nerve.

2. The lower thoracic spinal nerves influence the kidneys by reason of their connection with the lesser and smallest splanchnics, which communicate with the renal plexus. The tenth dorsal is the one which has the greatest influence on the kidney.

The Innervation of the Suprarenal Capsule.—The ninth thoracic nerves have the greatest influence on the suprarenal capsule. The suprarenal plexus, which supplies the adrenal bodies, is formed by branches from the solar plexus, the outer part of the semilunar ganglion, and from the phrenic and great splanchnic nerves, a ganglion being formed at the point of junction of the latter nerve. The branches of this plexus are remarkable for their large size in comparison with the size of the organ which they supply.

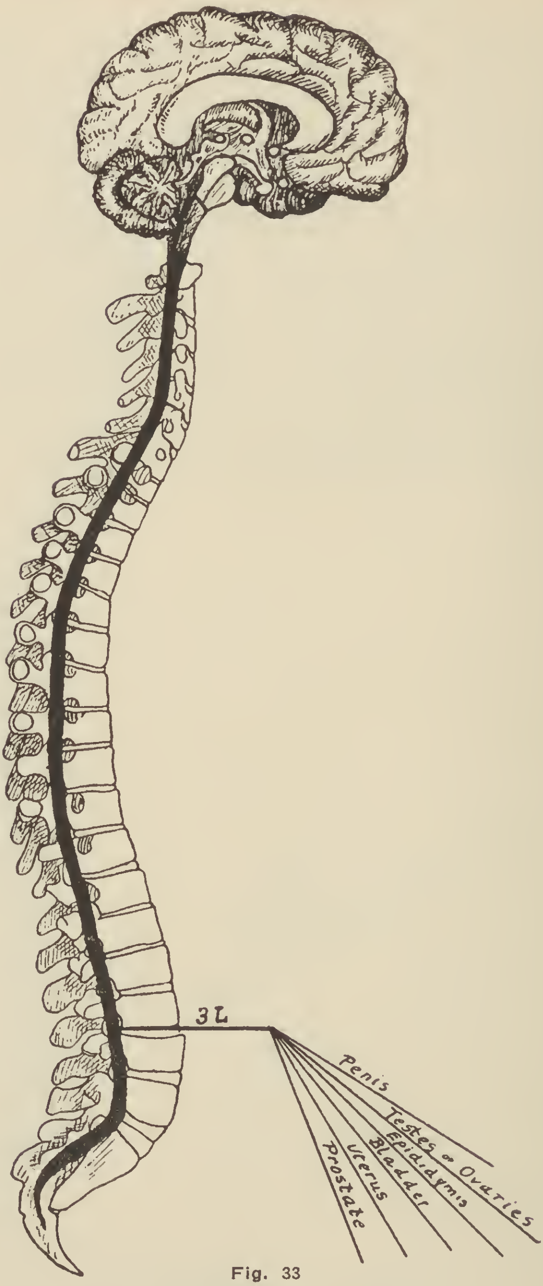

Fig. 33
Parts Influenced by the Third Lumbar Nerve.

CHAPTER IV

The Innervation of the Organs of the Pelvis

The Innervation of the Bladder.—The nerves of the bladder are derived from the pelvic plexus of the autonomic and from the second, third and fourth sacral nerves; the former supply the upper part of the organ, while the latter supply its base and neck. The autonomic fibres have ganglia connected with them, which send branches to the vessels and muscular coat. The pelvic plexus is formed by a continuation of the hypogastric plexus, by branches from the second, third, and fourth sacral nerves, and by a few filaments from the first two sacral ganglia. From this plexus numerous branches, which accompany the branches of the internal iliac artery, are distributed to all the viscera of the pelvis.

The specific plexus which supplies the bladder is the vesical plexus, which arises from the fore part of the pelvic plexus. The nerves composing it are numerous, and contain a large portion of spinal nerve-fibres. They accompany the vesical arteries, and are distributed at the side and base of the bladder. Numerous filaments also pass to the seminal vesicles and vas deferens; those supplying the vas deferens unite with branches of the spermatic plexus on the spermatic cord.

The spinal nerves which have the greatest influence on the bladder are the eleventh thoracic and the fourth lumbar. These nerves communicate with the vesical plexus by connecting with the corresponding ganglia of the autonomic, which send internal branches that communicate with the hypogastric plexus.

The most marked effect upon the bladder is obtained by adjustment of the eleventh dorsal and fourth lumbar vertebrae.

The Innervation of the Uterus.—The nerves to the uterus are derived from the inferior hypogastric and ovarian plexuses, and from the third and fourth sacral nerves. The uterine plexus which specifically supplies the uterus arises

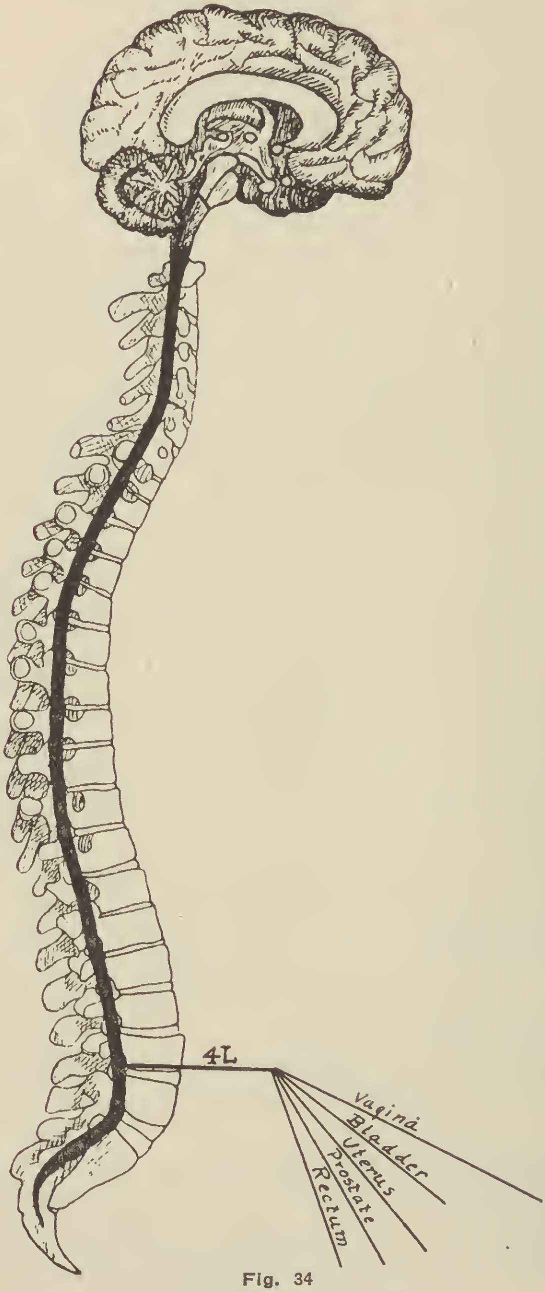

Fig. 34
Parts Influenced by the Fourth Lumbar Nerve.

from the upper part of the pelvic plexus above the point where the branches from the sacral nerves unite with that plexus. Its branches accompany the uterine arteries to the side of the organ between the folds of the broad ligament, and are distributed to the substance of the lower part of the body of the uterus and to the cervix. Branches from the uterine plexus also accompany the uterine arteries into the substance of the organ, and have numerous ganglia developed upon them. Other filaments pass separately to the fundus and the Fallopian tubes.

The following spinal nerves influence the uterus:

1. The lower thoracic nerves, through their communication with the pelvic plexus have an influence on the uterus.

2. The lumbar nerves also influence the uterus by reason of their communication directly with the hypogastric and uterine plexuses. The fourth lumbar especially controls the uterus, and adjustment of this vertebra is indicated in various uterine disorders.

The Innervation of the Prostate Gland.—The nerves which supply the prostate gland are derived from the pelvic plexus, through the medium of the prostatic plexus. The nerves composing this plexus are of large size. They are distributed to the prostate gland, seminal vesicles, and erectile tissue of the penis.

The spinal nerves which have an influence on the prostate gland are the following:

1. The lower thoracic spinal nerves, by their connection with the pelvic plexus have some influence upon the prostate gland.

2. The lumbar nerves, however, have the most marked influence upon this organ, and the nerves which most directly influence it are the first and fifth lumbar.

The Innervation of the Ovaries.—The nerves which supply the ovary are derived from the pelvic plexus and from the ovarian plexus. The pelvic plexus has been previously described. The ovarian plexus is derived from the renal plexus, and is distributed to the ovaries and the fundus of the uterus.

The spinal nerves that influence the ovaries are the following:

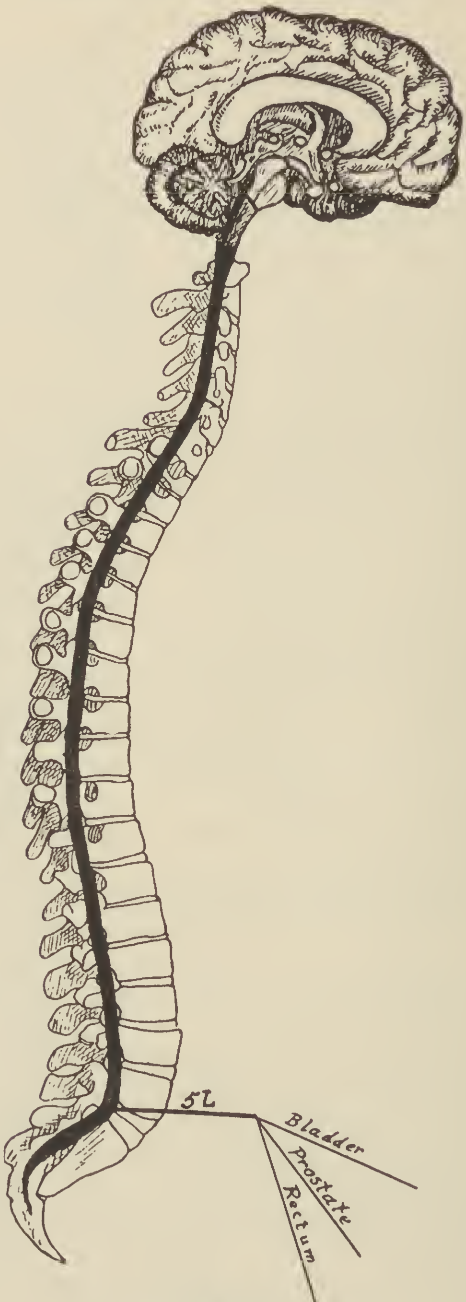

Fig. 35
Parts Influenced by the Fifth Lumbar Nerve.

1. The tenth, eleventh, and twelfth thoracic nerves form the lesser and smallest splanchnics, which assist in the formation of the renal plexus from which the ovarian plexus is derived.

2. The lumbar nerves, by their connection with the lumbar ganglia which assist in the formation of the hypogastric plexus from which the pelvic and finally the ovarian plexus are derived, also influence the ovaries. The third lumbar nerve, especially, influences the ovaries.

The Innervation of the Testicles.—The nerve-supply of the testicles is analogous to that of the ovaries. It is derived from the spermatic plexus which, like the ovarian plexus, is a branch of the renal plexus. It accompanies the spermatic vessels to the testes.

The spinal nerves which influence the testes are the same as those which influence the ovary.

The Innervation of the Vagina.—The nerve-supply of the vagina is derived from the vaginal plexus, which arises from the lower part of the pelvic plexus. It is lost on the walls of the vagina, being distributed to the erectile tissue on its anterior part and to the mucous membrane. The nerves comprising this plexus contain, like those of the vesical, a large number of spinal nerve-fibres.

The spinal nerves which influence the vagina are identical with those which affect the uterus.

The Innervation of the Penis.—The nerves which supply the penis are comprised of two sets, namely, the large and small cavernous nerves. These are slender filaments which arise from the front part of the prostatic plexus, and, after uniting with branches from the internal pudic nerve, pass forward beneath the pubis.

The second and fourth lumbar nerves are the spinal nerves which have the most decided influence upon this organ, by reason of their connection with the hypogastric plexus through the corresponding lumbar ganglia.

SECTION FOUR

Vertebral Subluxation

CHAPTER I

The Etiology of Abnormal Nerve Function

We have seen in the previous section that the nervous system penetrates every part and parcel of the body. So much so, that were all the other portions of the body removed and the nervous system left intact, the human figure could still be recognized. Fig. 36.

It was also shown how every part of the body is dependent upon the nervous system for its organic integrity and its functional activity.

As a result, were the human organism deprived of this dynamic influence, the harmony normally existing between its component parts would be destroyed, and functional and organic disorders would rapidly supervene.

Even though the brain and spinal cord, which are the producing and receiving centers of all impulses, be organically and functionally perfect, they would be useless, were the irritability and conductivity of the nerves impaired. This is true because the brain and cord are as dependent on the nerves for transmitting impulses to and from them as are the nerves on the brain and cord for the receiving of impulses.

So long, therefore, as the nerve irritability and conductivity are intact, there will be a normal flow of impulses and a condition of health. When, however, the nerves are prevented from conducting a continuous flow of impulses, the vital processes are impaired, and the body then becomes susceptible to the secondary and contributing factors in the production of disease. An acute disease may follow. If the interference with the nerve impulses persists, it becomes the cause of the continuance of a chronic disorder.

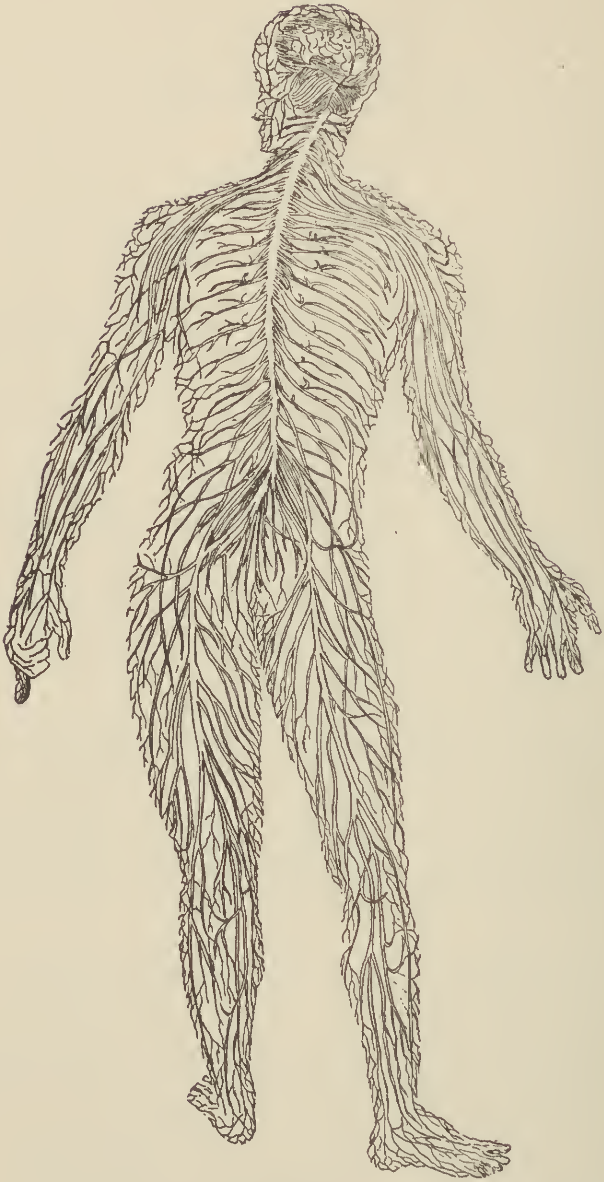

Fig. 36
Phantom of Nervous System.

The Causes of Disturbed Nerve Function.—A thorough knowledge of the various ways in which disturbed nerve function may be produced is naturally very important, for upon the principal cause of this disturbed function, namely, vertebral subluxations, depends the science of Chiropractic. A detailed discussion of the causes of disturbed nerve function other than vertebral subluxations is scarcely necessary in a work of this nature, and they will be referred to only briefly.

The causes of disturbed nerve function embrace those factors which operate to alter the strength of the conduction process, for upon its conductivity depends its functional activity, namely the conveying of impulses to and from the central nervous system. These causes may, accordingly be classed as follows:

(a) Fatigue.
(b) Malnutrition.
(c) Traumatism.
(b) Extremes of Temperature.
(e) Chemicals and Drugs.
(f) Mechanical Conditions.

Fatigue of Nerves.—Almost every form of protoplasm, when stimulated to prolonged action, deteriorates and finally fails to act. Such cannot be said of nerve-fibres, however, for they have been experimentally excited numerous times per second, for many hours, and still, at the end of that time, were capable of developing an impulse at the stimulated point. Why this is so is still not known. If, as is generally supposed, the nerve-impulse is a form of energy which passes along the length of the nerve, and since the liberation of energy implies the breaking down of chemical combinations, it seems strange on a superficial view that fatigue apparently does not result. The nerve-cells, however, appear to tire after frequent excitation. This fact appears to make the lack of fatigue of the nerve-fibres still more perplexing, since the latter are direct processes of the nerve-cell.

Fatigue of nerves must therefore be looked upon as fatigue not of the conduction apparatus, but of the centre which generates the impulse. That the conduction of nerve-

impulses does not exhaust the nerve-fibre shows that the process of conduction does not involve any change in the substance of the nerve-fibre. Generation of the impulses does not involve chemical changes in the nerve-centre, and therefore the nerve-cell may become exhausted; conduction of the impulse does not involve any chemical change, and hence the nerve-fibre does not become fatigued by conducting the impulses, no matter how often repeated.

Consequently, when the nerve-fibre is experimentally excited, it does not become fatigued because it has generated nothing at the expense of its own structure, the impulse which it conveyed having been generated by the electric apparatus which excited the nerve to action, and acted in the same capacity that the nerve cell does in the living body.

Fatigue of a nerve-centre is well illustrated by the inability to detect the odor of a perfume of a certain kind, after having previously smelled various other kinds. The repeated stimulation of the olfactory centre tires it until finally it no longer correctly interprets the impulse received and is unable to send an impulse to the olfactory portion of the Schneiderian membrane of the nose to which the sense of smell is referred.

Malnutrition of Nerves.—The nerve-fibre, in order to preserve its irritability, must receive a constant supply of blood. Even though the nerve-fibre depends for its nourishment upon the cell-body from which it is derived, it must be plentifully supplied with blood and also oxygen. For example, it is seen, experimentally, that a nerve retains its irritability much longer in oxygen than in air and longer in air which contains oxygen than that which does not.

Malnutrition, therefore, is always productive of disturbed nerve function. When, for example, the abdominal aorta of a rabbit was ligated, complete paralysis of the lower limbs, both motor and sensory, followed very soon. This paralysis was due, in the first place, to loss of function of the nerve-cells in the spinal cord, and later to loss of irritability of the nerves of the limbs.

This shows that nerves deprived of their nourishment lose their function. Such deprivation of the nerves of blood and oxygen occurs in the living body when an improper

quality or a deficient quantity of food is ingested. It is also a result of faulty digestion and assimilation.

The nerve-cells in the spinal cord derive their blood-supply from the vessels in the sheath of the spinal cord. If a misplacement of a vertebra, sufficiently marked to produce pressure upon these vessels by the margins of the intervertebral foramen occurs, the nourishment of the corresponding segment of the cord suffers. As a result of this the nerve-cells in that segment are affected, and we find disturbed function in those parts of the body supplied by the nerve-cells which are involved.

Traumatism of Nerves.—The point at which a nerve is most liable to injury is at the intervertebral foramina. The place of injury to a nerve where the greatest measure of ill effects ensue is also at the intervertebral foramina. They are most liable to injury at this point because in this location along their course they pass between movable bones which are subject to more or less marked displacement.

The nerves naturally may be injured at any point along their course, but such an injury is usually local in its effects, and regeneration soon occurs, with reëstablishment of the function of those parts supplied by it. But when the injury is produced by a subluxated vertebra, it persists until mechanically corrected. Since the primary divisions of the nerves in such cases are affected, the effects are marked in their distribution and severity.

That pressure upon a nerve disturbes its power of conductivity everyone has had occasion to demonstrate on himself. For example, if pressure is brought to bear upon the ulnar nerve where it crosses the elbow, the region supplied by the nerve becomes numb.

The most common ways in which nerves are injured are by tearing, blows, cuts, pinching, twitching, stretching, and pressure.

The most important of these is pressure at the intervertebral foramina, for the reason that the producing cause remains in operation until the vertebral misplacement is corrected by "adjustment" of the vertebra. The effects of such pressure vary from those of slight, to those of the greatest seriousness.

The Effect of Extremes of Temperature on Nerves.— Changes in temperature, if sudden and extreme, irritate nerves. If, for example, the elbow be dipped in ice-water, the ulnar nerve is excited, and in addition to the sensations from the skin, the subject feels pain in all parts supplied by the nerve. As the effect of the cold becomes more marked, the pain is replaced by numbness, which shows that both the irritability and the power of conduction of the nerve have been reduced. As to increased temperature, it may be said that, raising the temperature above the usual temperature of the body increases the irritability of the nerves.

The same applies to the conductivity of the nerves. Thus, both the autonomic and the vagus nerve-fibres have their influence on the heart-beat increased by heat, and decreased by cold, in experiments on a frog.

It has been observed that if cold be applied locally to a nerve, the part affected cannot conduct an impulse, and acts as a block to the passage of any impulses along that nerve. On the other hand, the impulse is increased in strength if it passes through a part which has been previously warmed.

The proper temperature of the body is maintained and equalized by the blood. In this way, in addition to other acts which it performs, it exerts a marked influence upon the irritability of the nerves, and their conductivity. Thus, when the artery passing through an intervertebral foramen in the sheath of the spinal nerve is compressed as a result of a subluxation of a vertebra, the heat which it conveys to the parts through the medium of the blood is withdrawn. This diminution of the amount of heat, in addition to the defective nutrition which also results, causes the power of conductivity of the nerve to become enfeebled.

The Effect of Chemicals and Drugs on Nerves.—The irritability of nerves is greatly influenced by even slight changes in the constitution of their protoplasm. Thus, if a nerve be allowed to lie in a liquid of a different nature than its own normal fluid medium, and especially if such a liquid enters the blood vessels which supply the nerve, its irritability is soon destroyed.

For these reasons a certain chemical constitution of the nerve protoplasm must be maintained, because even slight

variations from this will alter or destroy the irritability of the nerve.

The first result of chemicals is to increase the irritability of the nerves, but this effect is only transient, and, as stated above, is soon followed by a diminished irritability. Various drugs used to stimulate nerve-action accomplish the desired result, but the effects are not lasting, and finally are wanting altogether. For example, different drugs are given in constipation to promote evacuation of the bowels. At first these drugs sufficiently arouse the irritability of the nerves controlling the bowels to produce the effect desired, namely, evacuation of their contents. Finally, however, one after another, these drugs fail to act, the irritability of the nerves having been so diminished that impulses are no longer generated and conveyed to the parts supplied. It is for this reason that drugs are so uniformly useless in the treatment of chronic constipation.

Other drugs are used for their depressing effect, namely, to retard nerve function. This is also accomplished by rapidly diminishing the irritability of the nerves, and by directly benumbing the nerve-centers, or by overstimulating the nerves until a state of exhaustion supervenes.

The Effect of Mechanical Conditions on Nerves.—This, the most common of all the causes of disturbed nerve function, has had less attention than any of the other causes enumerated.

A sudden blow, pinch, twist, or cut excites a nerve. We have all experienced this effect on a sensory nerve, by accidental blows on the ulnar nerve at the point where it passes over the elbow, "the funny bone."

Mechanical applications to nerves first increase and later lessen and destroy their irritability. Thus pressure, gradually applied, first increases and later diminishes the power to respond to irritants.

The most common form of continuous pressure upon a nerve is that produced by the margins of the intervertebral foramen when a vertebra is subluxated. A slight amount of pressure of this kind upon a nerve will increase its irritability. Its action will then be increased. Continuous pres-

sure of a more marked degree will finally destroy all sensibility of the nerve and cause its action to be abolished.

The power of conductivity of nerves is similarly affected by pressure upon them. The effect of pressure to lessen the conductivity of nerves is one which every one has had occasion to demonstrate on himself. For example, if pressure be brought to bear on the ulnar nerve where it crosses the elbow, the region supplied by the nerve becomes numb.

The great majority of all the functions of the various systems of the body are produced as a result of the mechanical stimulation of the afferent nerves from such organs. Thus the presence of food in the mouth reflexly excites the secretory activity of the salivary glands. This is accomplished by the sending of an afferent impulse from the nerve-endings in the mouth, which reflexly produces a stimulus through the efferent nerves to the salivary glands, with the result that saliva is produced.

From the foregoing it is apparent that although there are other causes than vertebral subluxations which operate to produce abnormal nerve function, still such displacements are really the underlying cause in most cases. Whether the cause ascribed be malnutrition, or some other cause, such a cause is usually secondary to a preëxisting vertebral displacement, and these, therefore, become the most important single factor in the production of disturbed nerve function.

CHAPTER II

Vertebral Subluxation

The human body is generally regarded as a most wonderful and intricate piece of mechanism. The central pivot, upon which hangs every unit of this mechanism, is the vertebral column. The spine thus becomes the most important part of the body.

It is strange, therefore, that so very little time has been devoted to the study of this part of the body. Every other portion has received careful consideration by the students of anatomy, but the spine has received very slight attention. So also, clinicians have investigated everything having the slightest bearing on the production of disease, but the possibility of minor lesions in the spine as a factor in producing disease has been entirely overlooked until recently.

If, as previously pointed out, proper function and organic integrity of every part of the body depend upon normal nerve function, then the vertebral column is the most important part of the body from a clinical viewpoint. This is true for the reason that the location at which interference with nerve function is most likely to occur is at the point where soft nerves pass between hard, movable bones, namely, through the intervertebral foramina, and where they are constantly in danger of being impinged upon. This impingement, as we have already seen, will so impair the conductivity of the nerves as to check the flow of impulses to the parts for which they are destined.

It is true that major lesions of the spine have received proper attention. But the possibility of the existence of minor injuries has never been investigated until the clinical results obtained through spinal adjustment made it plain that vertebral lesions of a minor character are the greatest single factor in the production of disease.

Probably another reason why vertebral subluxations have received so little credit in the etiology of disease is that, while the body has always been regarded as a piece of

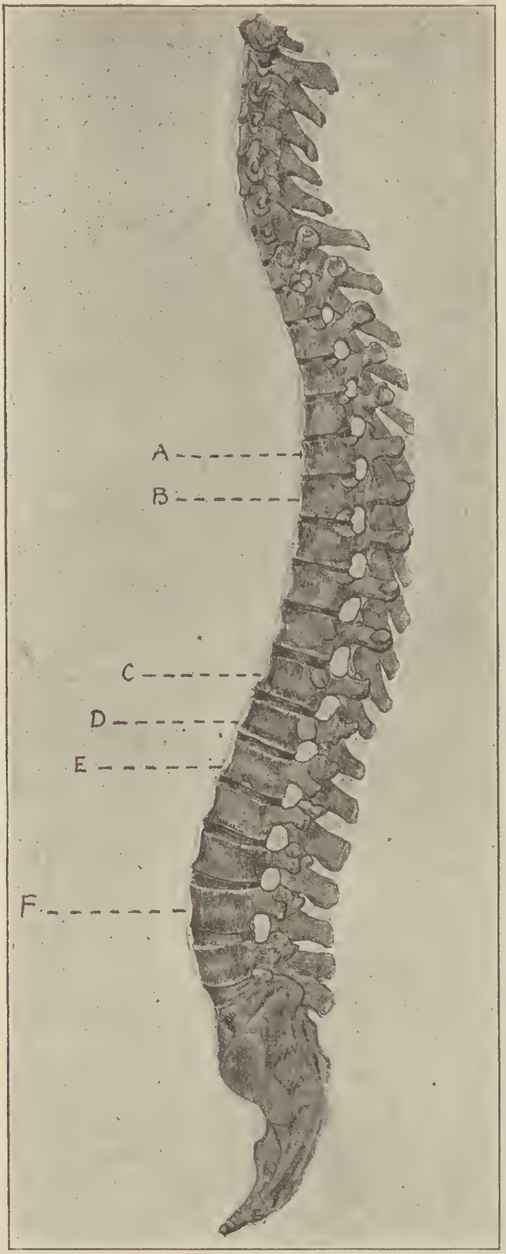

Fig. 37
THE NORMAL SPINE
This illustrates the normal spine. Compare it with Fig. 40, which shows certain vertebrae subluxated, as described under that figure.

mechanism, its mechanical possibilities have never been studied.

The Nature of Subluxations.—An exact knowledge of precisely what is meant when the term "subluxation" is used, has been the chief cause of the failure of many to investigate spinal adjustment.

The general opinion has been that by the term subluxation a dislocation is understood to be implied. Such is, however, the wrong construction of the term, and a complete dislocation in the general acceptance of that word, is not what the term implies. A dislocation of a vertebra without fracture is practically impossible. A subluxation is not a disarticulation of a vertebra from the adjacent vertebrae above and below it. It is simply a slight change in the relative position of a vertebra with the contiguous surfaces of the vertebrae above and below it. That is to say, instead of the entire surface area of a vertebra being approximated, with die-like precision, to its fellows above and below, it is slightly moved from this position. There is not an absolute and entire separation of the articular processes of two vertebrae; the greater part of their surface area still oppose each other; there has simply been a shifting of the position of one upon the other. This movement is in various directions depending on the configuration of the articular processes and the manner of application of the forces which produce the displacement. These various forms of subluxations will be considered in detail in a future chapter.

When misplacement of a vertebra occurs, the lumen of the intervertebral foramen must of necessity be encroached upon by the displaced portions, and its opening narrowed. This fact rests upon the physical axiom that, any movement toward the centre of an opening of the parts bounding it, diminishes its area. Further, whatever is contained in a space so diminished in area is either compressed or displaced. If it is softer than the parts pressing upon it, compression will occur. This is what occurs in vertebral subluxations, where hard bone presses on soft nerves, blood-vessels, and lymphatics.

This, then, is what is meant by vertebral subluxation, namely, a displacement of a vertebra, resulting in an im-

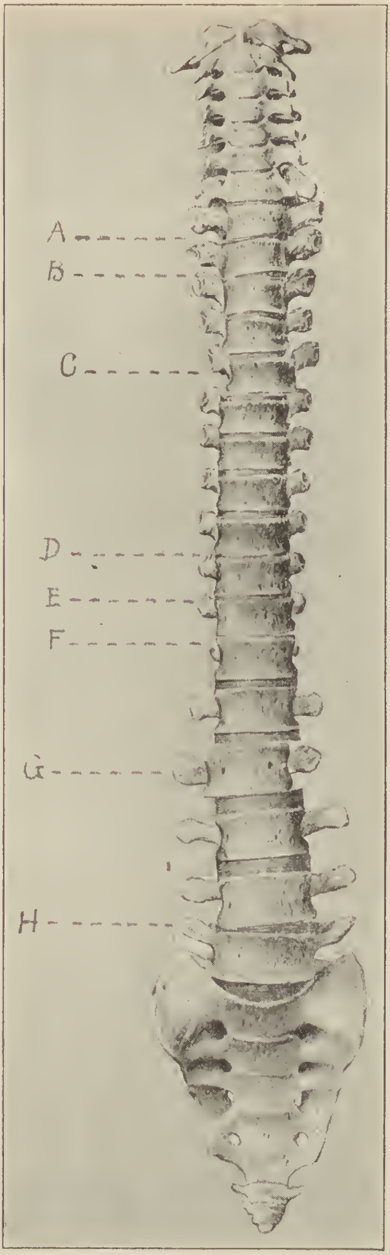

Fig. 38

ANTERIOR ASPECT OF SPINE

(A and B) Compression of the right side of the discs between the first, second, and third dorsal vertebrae with approximation of these vertebrae on that side and narrowing of the intervertebral dorsal foramina.

(C) Lateral displacement of the fifth dorsal vertebra to the left.

(D, E, and F) Compression of the anterior portion of the discs between the ninth, tenth, eleventh, and twelfth dorsal vertebrae.

(G) Rotary displacement of the second lumbar vertebra to the right side.

(H) Compression of the right side of the disc between the fourth and fifth lumbar vertebrae.

pingement of the structures in the intervertebral foramen by the misplaced margins of the foramen.

General Results of Subluxation of the Vertebrae.—Minor vertebral lesions, as has been repeatedly mentioned, produce certain diseases. It is not intended to convey the impression that all diseases are due to lesions of the spine. There are some disorders which are so evidently the result of other factors, that it would be irrational to presume that a vertebral subluxation was responsible for the abnormality in question. But it is a fact which cannot be successfully denied that not one other single thing is productive of so many abnormal conditions as are subluxations of the vertebrae. This statement is not only vouched for by a thorough study of the "mechanics" of the vertebral column, but is also proven by the clinical results achieved by adjustment of the vertebrae wherever subluxations are the basis of abnormal conditions.

Spontaneous Adjustment.—A great majority of the subluxations which are sustained during the day are corrected during sleep. Nature, in every case, makes an effort to correct spontaneously all the slight displacements of the vertebrae incurred during the previous day. When we are relaxed in sleep, those vertebral subluxations which are not too severe are adjusted in this way. When, however, a vertebra is so far out of alignment that the equalizing of muscular and ligamentous laxity and rigidity on both sides will not permit it to spontaneously resume its proper position, then mechanical means are required.

Sleep is the great restorative of vital energy because it produces a state wherein the generation of nerve-impulses is temporarily diminished or suspended. It is because the continuous flow of impulses ceases during this time, that the state of constant contraction of the muscles is absent, and relaxation of muscles and ligaments takes place. In like manner, most organs, during deep sleep, cease to function because the nerve impulses necessary to their functional activity are not being generated. Were the nerve impulses still flowing along the nerves as during our waking hours, there would be no relaxation during sleep, and the organs would never rest.

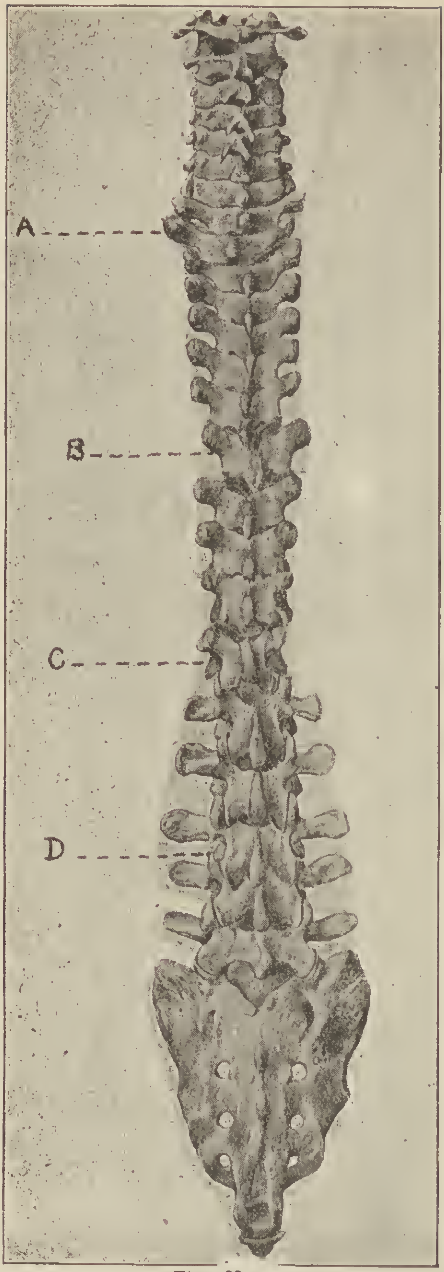

Fig. 39

POSTERIOR ASPECT OF SPINE

(A) Lateral displacement of the second dorsal vertebra to the left.

(B) Lateral displacement of the eighth dorsal vertebra to the right.

(C) Compression of the left side of the disc between the twelfth dorsal and first lumbar vertebrae resulting in a tilting of the twelfth dorsal.

(D) Inferior displacement of the third lumbar vertebra due to thinning of the posterior portion of the disc between it and the fourth lumbar vertebra.

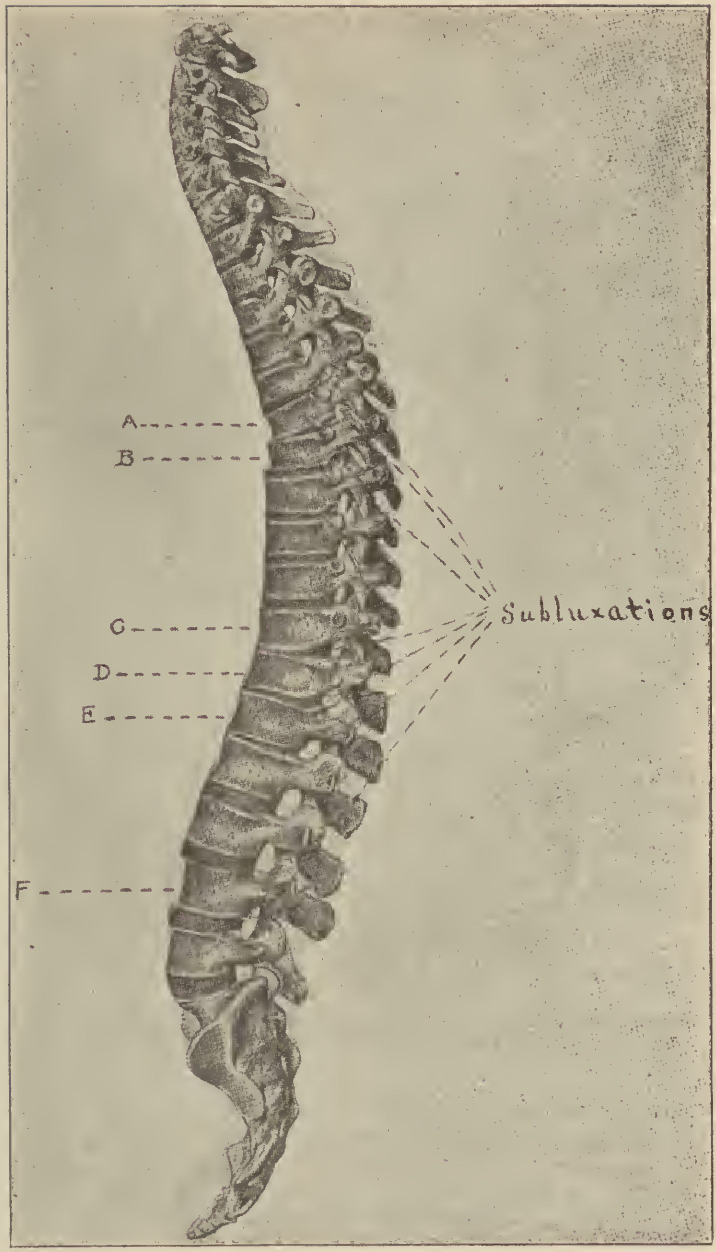

Fig. 40

LATERAL ASPECT OF SPINE

(A and B) The anterior portion of the intervertebral disc is thinned, and as a result of the approximation of the vertebrae the intervertebral foramina are encroached upon by the displaced articular processes.

(C, D, and E) The discs between these vertebrae are thinned and, owing to the approximation of the vertebrae, the vertical diameter of the corresponding intervertebral foramina is diminished.

(F) The fourth lumbar vertebra is displaced posteriorly and encroaches on the antero-posterior diameter of the intervertebral foramen below.

Fatigue, which is present at the end of the day, is simply, therefore, the result of exhaustion of the nerve centres. We retire at night, exhausted, and awaken in the morning, refreshed. The various minor vertebral lesions produced during the previous day, by the numerous external and reflex influences with which we were brought into contact, were spontaneously adjusted. A normal flow of impulses along the nerves is the result, and the effect of these impulses is perfect function, balanced metabolism, an equalized circulation of the blood, and perfect muscular tonicity. Were these bodily activities at all times in the state of balanced perfection that they are in the morning, we would never become exhausted, since the anabolic processes would compensate for the catabolic effects.

But we are not yet adapted to our present mode of living, and cannot successfully cope with the disadvantages which it entails. The air we breathe, the positions which our occupation make necessary, the food which we eat, and all the deleterious influences of our more or less artificial life act as reflex causes of minor vertebral lesions, by disturbing the balance of muscular laxity and rigidity.

As a result of these influences, various subluxations occur. Metabolism is disturbed, organs do not functionate harmoniously, the poisonous products of muscular activity begin to accumulate, the activity of the skin is diminished, and general exhaustion ensues.

Sleep then comes, and while the body is completely relaxed during this period of rest, the subluxations are spontaneously adjusted and normal conditions are restored.

It was stated above that certain subluxations may be so severe that it is not possible for nature to correct them spontaneously. These more marked subluxations then become a cause of disease. It is with these innumerable minor vertebral lesions that we have to deal.

CHAPTER III

The External Causes of Vertebral Subluxation

The etiological factors in the production of vertebral subluxations are generally very imperfectly understood. That they exist is freely conceded by those who have investigated the subject. A simple palpation of the vertebral column by one trained for the work will reveal the existence of subluxations in most sick people. Further, the fact that after a proper adjustment the same conditions no longer obtain, proves rather conclusively that subluxations of the vertebrae are not "myths."

A fact, however, which is little understood, even by practitioners of spinal adjustment, and a question concerning which arises in the minds of practitioners in other branches of the healing art, is: How are these displacements produced? Certainly, a force of some kind must be brought to bear upon the vertebrae or their supporting structures, the muscles and ligaments, to bring about the subluxation.

That we are constantly beset by circumstances which may produce subluxations of vertebrae was shown in the previous chapter. When, however, an unusual or a continuous force is brought to bear upon a certain region of the spine, a permanent subluxation is produced.

From a mechanical standpoint, every force, and by that term is included everything connected with our environment, has its influence upon the spine which is the central axis, or, as it has been termed, the "line-shaft" of the body. Every jar, fall, twist, jolt, etc., to which the body is subjected, if it is excessive and overcomes the elasticity of the intervertebral discs and the tonicity of the ligaments, will result in a subluxation.

The External Causes of Subluxations.—The chief external factors in the production of vertebral subluxations may be classified as follows:

1. Occupation.
2. Habits.
3. Injuries.
4. Age.
5. Exhaustion.

Vertebral Subluxation Produced by Occupation.—That certain forms of occupation predispose to various lesions of the vertebral column cannot be doubted. The slightest knowledge of mechanics will make this fact plain. It is physically impossible to assume a constant position, day after day, without some permanent change in the conformity of the parts which are thus changed taking place.

The factors that operate in the production of vertebral subluxations coincide with undeniable certainty with the occupational diseases as generally recognized. For example: the upper thoracic segments of the vertebral column control the heart and lungs; accountants, book-keepers, clerks, compositors, printers, bench-workers, dressmakers, tailors, and milliners, by the position which they assume at their work, develop a spinal curvature in the upper thoracic region of the spine; and it is well known that in these persons asthma, tuberculosis, and cardiac diseases are most prevalent. It is therefore because of the subluxations incident to their occupation that these diseases prevail in individuals following these occupations.

Those who follow sedentary occupations, having very little exercise, and working in situations where the air is vitiated, are susceptible to gastro-intestinal diseases, diseases of the respiratory system, and numerous nervous disorders. Owing to the deficient amount of exercise which these persons take, the tonicity of the muscular system becomes impaired, and subluxations are easily induced. Sedentary positions cause especially compression subluxations of the vertebrae in the lower dorsal and upper lumbar region, resulting in a deficient amount of nerve-impulses to the intestinal tract; as a result constipation, hemorrhoids (through sluggish circulation), etc., develop. Coincident with this, there is a stooping forward, tending to a backward displacement of the cervical and upper dorsal vertebrae, which may

inaugurate many disorders, depending upon the segment of the spine which is involved.

In those who follow occupations to which violent exercise is incident, subluxations of vertebrae are often directly produced, as for example, in those obliged to carry heavy weights, athletes, etc.

The above few generalizations serve to show the importance of occupation in the production of vertebral subluxations. It would be manifestly impossible to give in detail each occupation, with a list of the disease incident to such occupation, and the manner in which the subluxations are produced and bear a definite relationship to the diseases present. In every case, however, it should be ascertained whether the occupation is active or sedentary, or if the patient is subjected by his occupation to deleterious influences of any kind. Reflex subluxations, which will be considered in the following chapter, are frequently produced as a result of some factor in connection with the occupation. For example, the handling or breathing of toxic or irritating substances will reflexly produce subluxations. Thus engravers, potters, painters, dyers, etc., by inhaling dust-particles and gases, induce an irritative condition of the bronchial mucous membrane; this irritation excites the nerve-endings in this region, and the reflex action produced at the corresponding spinal segment is expressed on the musculature of that segment; the resultant contraction of these muscles ultimately produces a displacement of the vertebrae.

Vertebral Subluxations Produced by Habits.—Habits, especially those referring to the assuming of incorrect attitudes, are a prolific source of subluxations. The most common example of this that could be cited is the posture assumed by school-children, in whom almost every form of spinal displacement is thus produced, resulting in disorders of every description, depending upon the segment of the spine which is especially involved.

Vertebral Subluxations Produced by Injuries.—The vertebral column being the axis of the body, a force applied from any direction will be transmitted to the spine, and cause a more or less serious displacement of a vertebra.

This may be corrected immediately and no harmful results follow the momentary impingement of the nerve passing through the narrowed intervertebral foramen of the affected spinal segment. Or the subluxation may remain until the individual is relaxed in sleep, and be then spontaneously adjusted. However, if the displacement is marked, and a pronounced rigidity of the vertebral ligaments is present, the impinged nerve whose branches supply the vertebral ligaments in that area is prevented from sending to these ligaments the impulses necessary to the preservation of the balanced tonicity of the corresponding sides of the vertebral column. As a result of this condition, the subluxation is neither corrected at once nor during the period of complete relaxation of the individual in sleep, but persists. As a consequence of the interference with the autonomic fibres, vasomotor disturbances arise; the vessels are dilated, and a reaction of inflammation ensues. A greater or less organization of the products of inflammation now follows, forming adhesions, and the subluxation remains in a fixed position. Only mechanical means, properly directed, will now suffice to adjust the displaced vertebra to its proper position.

It may now be asked, granted that subluxation of the vertebrae may be brought about in the manner above described, do these causes occur as frequently as they necessarily must to coincide with the claim that most diseases are directly or indirectly produced by this factor?

If, most diseases are due to subluxations of the vertebrae, producing impingement of nerves and preventing their proper conduction of impulses, then the personal history of nearly all patients should cite the occurrence of some injury. Now, although the author shows that direct injury is only one etiological factor in the production of subluxations, if the personal history of all patients examined is carefully and studiously investigated, it is surprising what a great number show that some form of injury has been received at some time. The truth of this assertion was proven by looking over the case records of the clinical department of the National College of Chiropractic, in which it was

found that 60% of all examined showed mention of a recent injury.

Very often, these injuries left no immediate after-effects sufficient to fix a lasting impression on the patient's mind. Many patients, also, do not associate the previous injury with their present complaint, and thus fail to mention it when inquiry is made, moreover, the patient's mind is so engrossed with his present symptoms, that he has no thought of any previous injury, which may, as a matter of fact, date back ten or twenty years.

Works on diagnosis all mention the fact that in taking the patient's history full information regarding previous injuries should be elicited. Practitioners in general, however, do not seem to have regarded previous injuries as a very important factor in the production of disease, and very little attention has been paid to this etiological factor.

When we remember, that jars, falls, blows, strains, twisting, and other similar forms of traumatism may be so slight as to receive no consideration by the patient, and yet produce subluxation of a vertebra, we see how easily the connection may be lost sight of. Therefore, when after careful questioning of the patient, no history of a previous injury can be obtained, the possibility still remains that one may nevertheless have been suffered. However, if the patient be persistently questioned on this point, he will often finally recall a previous injury of some kind. We can readily demonstrate this on ourselves by trying to recall off-hand all the injuries which we have sustained during our own lifetime.

Jars produce subluxations by causing a thinning of the intervertebral cartilaginous discs; thus railroad men are affected by certain diseases incident to a settling of the spine in the lumbar region, popularly known as "railroad spine." This same term is also used to describe a neurasthenic condition following and persisting after injuries or shake-ups, like railway accidents.

Falls, sometimes of the slightest severity, may injure the muscles and ligaments of the vertebral column, resulting in a contraction of the muscles and ligaments of the region

affected. Thus numerous cases can be traced back directly to a fall received years previously.

Blows which cause an injury of the ligaments and muscles of the spine, will cause contraction of these muscles and ligaments, for the reason that traumatism of such structures causes them to become contracted. This can be easily demonstrated by striking the biceps with the ulnar surface of the hand; the local contraction of the muscle which follows is identical with that which occurs in vertebral subluxations except that in the latter case the contractured condition is more apt to be permanent. The lack of balance thus induced draws the vertebra toward the side of the contraction, and the lesion persists until relieved by mechanical means. Reflex subluxations may also be caused by blows which irritate or in any way excite peripheral nerve-endings.

Strains of moderate severity, which cause a tearing of some of the muscular and ligamentous fibres which hold the vertebrae in proper position, will also produce subluxation thereof. Should the strain be of even slight severity, the irritation of the muscles and ligaments will of itself be sufficient to cause a subluxation as a result of the contractured condition produced by the injury. Strains are produced in a great variety of ways and depending upon the region of the spine affected will be the disturbance resulting from the impingement of the structures passing through the intervertebral foramen which is involved. The simplicity with which such strains may be sometimes received are out of all proportion to the severity of the disorders which result, and these injuries should never be overlooked. Many cases are known in which a strain so slight at the time of its occurrence as to receive scarcely any attention, resulted in disorders of the greatest gravity, which were relieved entirely within a short time after adjustment of the subluxated vertebra.

Twisting of the spine, other than that which would come under the head of sprains, is a prolific source of vertebral subluxations. This has already been referred to under the head of habits, occupation, etc. Abnormal positions of the spine, if maintained for a sufficient length of time, will ulti-

mately produce changes in the bones and ligaments composing it. The intervertebral discs will become thinner on one side and remain thicker on the other; the ligaments will become shorter on one side and longer on the other. Finally the vertebrae are permanently out of their proper alignment, and the impingement of the nerves which follows leads to numerous and varied disorders.

Vertebral Subluxations Produced by Age.—As the declining years of life come on, the vertebral column gradually becomes shortened, settled, and less straight. This diminution in the length of the spinal column is principally at the expense of the intervertebral discs. Each day, as a result of muscular exhaustion, their is a certain loss in height. It has been shown that the average individual is from one-half to one inch shorter in the evening than he was in the morning of the same day. During youth, when rest and relaxation are perfect, and the elasticity of the tissues is marked, the settling of the spine which occurred during the day is entirely corrected during sleep. As age comes on, however, and rest and relaxation are imperfect, and the tissues are becoming less elastic, there is an incomplete return to the normal length of the spine, and gradually the shortening incident to old age comes on. Necessarily the deficiency in the amount of expansion which occurs during the night to compensate for the settling that occurs during the day, is exceedingly slight. But with the advancing years these differences become more and more apparent. As the intervertebral cartilaginous discs become more and more thinned, the intervertebral foramina become narrowed, and the structures which they transmit become impinged to an increasingly greater degree. Finally the lumen of the intervertebral foramen is narrowed to one-half its normal size, and the nerves are prevented from conducting the impulses necessary to the proper function of the parts which they supply. Functional and organic disorders of various organs then develop. Secretion is deficient, metabolism is disturbed, and the muscular structures lose their tone. Nature endeavors to compensate for this settling of the spine in the aged by causing it to bend forward. This is shown by examination of the spine of an aged person, when it will be

seen that the intervertebral discs are thinned anteriorly, and to a less degree posteriorly. This compensatory curve tends in a measure to prevent complete occlusion of the intervertebral foramina, though not wholly so. Were the settling of the spine which accompanies old age to be prevented from occurring, and it can be prevented to a great extent, how many of the disorders peculiar to this period of life might not be eliminated?

Vertebral Subluxations Produced by Exhaustion.—Fatigue as a result of the muscular exhaustion incident to the activity during the day produces numerous vertebral subluxations. As already mentioned these subluxations are usually spontaneously adjusted during the period of sleep when complete relaxation of the ligaments and muscles is present. The settling of the vertebral column which occurs during the day causes a narrowing of the intervertebral foramina, producing slight impingement of the nerves and blood-vessels passing through them. This interference with the conductivity of these nerves and with the nutrition of the involved segments of the spinal cord produces a general depression of nervous tonicity, which is expressed as fatigue. Spinal adjustment, by restoring the normal size of these foramina, will relieve the exhaustion at once. It was this fact which was the underlying reason why the Bohemians who have practiced spinal adjustment for many years obtained the results they did by their crude methods, although the reason why such results were obtained were not understood by them.

The more excessive the muscular exhaustion of the day is the greater will be the degree of settling of the vertebral column. Occasionally, a vertebra may become so seriously displaced as a result of this loss of muscular tonicity that spontaneous adjustment will not take place. In such an event a permanent subluxation of the vertebra remains.

The feeling or sensation of exhaustion, like every other sensation perceived by a living organism, is perceived in the sensorium of the brain, and not in the end organs of the nerves. It is by means of the common sensations, of which fatigue is an example, that the individual is made aware of certain conditions in various parts of his body. The sensa-

tion of fatigue, further, is a subjective sensation, that is to say, one which is dependent upon internal causes. Fatigue, therefore, must be looked upon as the sensation which tells us that exhaustion of the body, either wholly or in part, is present. The sensation of exhaustion is perceived when the nerve-endings are irritated by the poisonous by-products of muscular activity. As a result of the settling of the spine consequent on the lack of muscular tonicity and the thinning of the intervertebral discs, the venous flow from each spinal segment is obstructed, and these poisonous by-products have a toxic influence upon the corresponding segments of the spinal cord. The reflex centres are affected, and a want of harmonious action between the cerebrospinal and autonomic divisions of the nervous system results. If one portion of the body is especially exhausted the reflex excitation of its reflex centre is expressed upon the musculature of that spinal segment and a subluxation results. In this manner a subluxation may be produced not alone by direct failure of the exhausted muscles to hold the vertebra in its proper position, but also by a reflex motor impulse produced by the toxic excitation of the reflex centre in the cord.

CHAPTER IV

The Internal Causes of Vertebral Subluxation

It is freely admitted that not all diseases are produced by lesions in the vertebral column. By some Chiropractic writers the assertion has been made that all disease is due to subluxations of the vertebrae, and that all disease is curable by adjustment of displaced vertebrae. Such a view is erroneous.

The main reason why this opinion was formed is perhaps due to the fact that whenever an abnormal condition obtains in any part of the body, a vertebral subluxation may be found at the point of emergence of the nerves which control that part. Not only that, but it is true that in most instances the abnormality may be removed by the adjustment of such a subluxation.

In view of these facts, some Chiropractors fail to recognize the further fact that not only may such subluxations produce disease, but a pre-existing disease may bring about subluxation of a vertebra.

Some writers have taught that diseased organs may reflexly produce subluxation of vertebrae, but scientific explanations of this phenomenon have been wanting, or, where attempted, have been too involved and complicated to be satisfactory.

The exact manner in which pathological conditions, as well as other deleterious influences, produce subluxations is reflexly. The exact manner in which this occurs will be shown in this chapter.

The Reflex Cycle.—The first essential to an understanding of the reflex production of subluxations of the vertebrae is a thorough knowledge of the reflex cycle. This includes the reflex arc of nerves and the reflex act.

For the performance of a reflex act the following anatomical structures must exist: A receptive peripheral nerve-ending; an afferent path leading to the brain or cord; cells in the brain or cord by which the incoming impulses shall

be there distributed; and a set of efferent nerves to carry the outgoing impulses to the terminal organ which gives the response. The afferent and efferent paths over which the impulses in a reflex act travel are (1) the sensory and motor fibres of the spinal nerves, associated in the gray matter of the cord; (2) the sensory and motor fibres of the cranial nerves, which are connected in the brain; (3) the afferent spinal fibres, the posterior longitudinal bundle, chiefly, and efferent cranial fibres; (4) the afferent cranial and efferent spinal nerve-fibres, the two being associated by the anterior longitudinal bundle, the spinal root of the fifth nerve, the vestibulo-olivary and vestibulo-spinal tracts, the solitary bundle, etc.

Preceding a discussion of the exact manner in which vertebral subluxations are produced reflexly, consideration of each of the above forms of reflexes will be taken up.

Spinal Reflexes.—In the most simple spinal reflexes the afferent fibres of the reflex arc arborize about the cell-bodies whose branches constitute the efferent fibres. Among them are the skin and muscle reflexes, such as the patellar, the gluteal, and the plantar reflexes, the involuntary withdrawal of a part from a source of irritation, etc.

Among the more complex spinal reflexes are the cardio-accellerator reflexes, vaso-motor reflexes, micturition, parturition, and defecation. As an example, let us trace a defecation reflex: the rectum is supplied by the third and fourth sacral nerves and by branches from the inferior mesenteric and hypogastric plexuses. Irritation of the nerve-endings in the mucous membrane of the rectum is caused, normally, by the presence of fecal matter. The impulses caused thereby run to the spinal defecation center in the lumbar enlargement of the spinal cord, either by way of the sacral nerves or through the autonomic plexuses, the gangliated cord, and the rami communicantes to the lumbar nerves, through the posterior roots of which they reach the defecation center in the cord.

From the defecation center the outgoing impulses follow two courses: first, they descend through the third and fourth sacral nerves and cause inhibition in the circular fibres of the rectum and contraction of the longitudinal muscle. Sec-

ondly, the above action is immediately followed by impulses which pursue the autonomic course, through the anterior roots of the lumbar nerves, the rami communicantes, the gangliated cord, and the inferior mesenteric and hypogastric plexuses, to the rectum. They cause, in succession from above downward, contraction of the circular muscle of the rectum. The two series of impulses thus open a way for the passage of the fecal matter, and then force it through the opening, unless prevented from doing so by the voluntary contraction of the external sphincter of the anus.

From the foregoing it is apparent that mental impulses have nothing to do with the activity of the bowels and that constipation is not due, as some teach, to lack of mental impulses to the intestinal tract.

Cranial Reflexes.—The simplest type of this class of reflexes are such as spasm of the muscles of mastication as a result of a bad tooth, in which both limbs of the reflex arc are formed by the trifacial nerve. Another example is the facial expression of pain also due to the same cause, and in which case the reflex arc is formed in addition by the facial nerve; that is, the impulses traverse the trifacial nerve and by the collaterals of its root-fibres reach the nucleus of the facial nerve, through which nerve they cause contraction of certain muscles of expression.

Examples of the more complicated cranial reflexes are: the salivary reflexes in which the sight or smell of food causes the flow of saliva; coughing, vomiting, sneezing, and deglutition reflexes are further examples. All of these reflexes can be readily traced if a knowledge of the nerve-supply of the parts is had.

Spinal and Cranial Reflexes.—Impulses received by the spinal cord through the afferent fibres of its nerves are transmitted by the posterior longitudinal bundle to the nuclei of motor cranial nerves. Thus are brought about movements of the eyes toward the source of the impulse, a change of facial expression to agree with the painful or pleasing character of the impulses, etc.

Cranial and Spinal Reflexes.—There is a great number of this class of reflexes, of which we will note three examples: First, in the respiratory reflex, any obstruction

or irritation of the larynx or trachea sends an impulse through the pneumogastric nerve to its sensory nucleus ambiguous and nucleus of the phrenic nerve in the cervical cord, causing increased respiratory effort, coughing, spasm of the muscles closing the glottis, etc. Second, the auditory reflex is illustrated by the turning of the head upon hearing a sudden sound; also the sudden starting caused by hearing a very loud sound. The path for the latter is probably as follows: The auditory nerve, the vestibulo-olivary and vestibulo-spinal tracts, anterolateral ground bundle, and efferent fibres of spinal nerves. Third, pupillary reflexes belong to the cranial and cranio-spinal group of reflexes. The ciliospinal centres are in the cervical enlargement of the spinal cord, the pupillo-dilator centre being in the upper part, and the pupillo-constrictor centre in the middle part of that enlargement. They receive optic impulses through the anterior longitudinal bundle from the superior quadrigeminal bodies. The superior quadrigeminal bodies receive those impulses by two routes: First, directly, through the fibres of the external root of the optic tract, and, second, indirectly, through centrifugal fibres in the optic radiations, and the superior brachium. By the latter route, the optic impulses which have reached the visual area of the occipital lobe, by way of the intrinsic retinal neurones and the optic nerves, tracts and radiations, are returned to the optic thalamus and external geniculate body and then carried back to the superior quadrigeminal bodies. From there, reaching the cilio-spinal centres through the anterior longitudinal bundle, the impulses take one of two possible courses: (a) They leave the spinal cord through the anterior roots of the upper thoracic nerves and run, in succession, through the rami communicantes, the cervical portion of the gangliated cord, the cavernous plexus, the ciliary ganglion, and the short ciliary nerves to the radiating fibres of the iris, producing dilation of the pupil. (b) From the pupillo-constrictor centre the impulses are carried upward by the posterior longitudinal bundle to the nuclei of the motor oculi nerve, where they are reinforced by optic impulses received directly through the superior quadrigeminal body and posterior commissure. The impulses reach the ciliary muscle and the

circular muscle of the iris through the motor oculi nerve, ciliary ganglion and short ciliary nerves. The result is a contraction of the pupil.

The Reflex Act.—The nervous mechanism concerned in the reflex act has the following arrangement: Afferent fibres running from the periphery, and entering the cord by way of the posterior nerve-roots; the central mass of the spinal cord itself in which these roots end, each root marking the middle of a segment; within the cord and stretching its entire length are the central cells, interpolated more or less numerously between the terminals of the afferent neurones and the cell-bodies of the efferent neurones. From each segment of the cord go to pass the anterior root-fibres, going in part to the muscles and in part to the ganglia of the autonomic system.

In a reflex act, the response is not accompanied by consciousness. When an impulse enters the central system by way of the posterior root, it is found to follow the course of the afferent axones within the central system, and thus must be distributed almost simultaneously to a length of cord coextensive with that of the branches of the afferent axones. The parts which respond to the afferent impulses of the reflex act, however, are those innervated from the same segments of the cord which receive the sensory nerves that have been stimulated. Thus stimulation of the skin of the breast causes movements of the arms. Still, while sensory impulses coming into any segment tend to rouse exclusively the muscles innervated by that segment, these incoming impulses are distributed in the cord unevenly and in such a way as to easily involve segments controlling other parts of the body.

When the stimulus is applied on one side of the median plane, the responses first appear in the muscles of the same side; and if the stimulus is slight, they may appear on that side only. The incoming impulses are therefore first and most effectively distributed to the efferent cells located on the same side of the cord as that on which these impulses enter.

In a reflex response the strength of the stimulus is coextensive with the extent to which the muscles are contracted,

the number of muscles taking part in the contraction, and the length of time during which the contraction continues. A single stimulus very rarely, if ever, calls forth a reaction, if the time during which it acts is very short, and hence it is supposed that there is an accumulation of stimuli, implying that at some part of the reflex pathway there is a piling up of the effects of the separately inefficient stimuli to a point at which they become effective.

The foregoing paragraphs have been concerned mainly with the changes occurring in the afferent portions of the pathway. Next to be considered is the efferent pathway, and we find that the conditions for diffusion of the outgoing impulses are dependent on the arrangement of several cells in series. When a group of efferent cells discharges, we know from the arrangement of the anterior roots that the impulses leave the cord mainly along the fibres which comprise these roots; but where the white rami of the autonomic system pass from the spinal nerves to the ganglia these outgoing impulses also pass over them, as well as over the few efferent fibres found in the posterior root. These axones carrying the outgoing impulses have two destinations: (a) The voluntary or striped muscle-fibres; (b) the autonomic nerve-cells in the ganglia of the gangliated cord.

Normally there pass from the central system along some of the nerve-fibres impulses which tend to keep the muscles in a state of slight contraction. Though the intensity of these outgoing impulses is normally always small, still it is subject to significant variations. The difference between the tone of the muscles of an athlete in prime condition and those of a patient recovering from a prolonged and exhausting illness is easily recognized, and this difference is in a large measure due to the difference in the intensity of the impulses passing out of the cord. Among the insane, too, the variations in this tonic condition follow in a marked way the nutritive changes in the central system, and both facial and bodily expression have a value as an index of the strength and variability of those impulses on which the tone of the skeletal muscles depends. This continuous outflow of impulses from the central system is indicated also by the continuous changes within the glands, and the variations in

these metabolic processes according to the activities of the central system.

Since the strength of the reflex responses depends upon the strength and number of stimuli of the afferent nerve-endings, it is apparent that anything which causes the excitation of these nerve-endings by irritating them, and thus producing stimuli which are carried to the reflex centres in the cord must be considered as the prime causative factor in the production of whatever response or action follows.

Take, for example, inflammatory conditions with ulceration, as seen in typhoid fever. Here we would have, instead of the normal condition of the bowel cited above under the head of spinal reflexes, the following change in the reflex act: instead of a mild contraction of the muscles of the intestinal wall there will be a marked contraction of these muscles, amounting to an actual spasm, known as tenesmus in the anus, and colic in the intestinal tract. This is simply due to the fact that now, instead of mild and few stimuli to the afferent nerve-endings, as produced by the presence of feces in the bowel, there are violent and numerous stimuli, as a result of the great irritation of the mucous membrane.

But a still more important and far-reaching effect is produced.

The Diffusion of the Outgoing Impulses.—In the peripheral system the nerve-impulse, when once started within a fibre or axone, is confined to that track and does not diffuse to other fibres running parallel with it, *but it does extend to all the branches of that axone, whatever their distribution.* In this physiological fact lies the key to the mode of production of reflex vertebral subluxations.

We have seen that the outgoing impulses pass over the anterior root of the spinal nerve, over the white ramus communicans, and over the efferent fibres in the posterior division of the spinal nerve. Since, as stated above, a nerve-impulse extends to all the branches of the axone in which it originates, it follows that in a reflex action the outgoing impulse will extend to every branch of the anterior root of the spinal nerve, of the ramus communicans, and of the efferent fibres in the posterior division of the spinal nerve.

The posterior division of the spinal nerve is the first di-

vision given off from it, and the efferent fibres in this root supply the musculature of the corresponding segment of the vertebral column. Consequently the first response to the outgoing impulse of a reflex act will be a contraction of the muscles of that spinal segment, for we have seen that the muscles that respond to the efferent impulse of a reflex act are those which are innervated from the same segment of the cord which receives the sensory nerves that have been stimulated. Further, the contraction of the muscles will be on one side only, for we have seen that all incoming impulses are distributed first and most effectively to the efferent cells on the same side of the cord as that on which these impulses enter.

The action produced by efferent impulses depends upon the character of the tissues in which the nerve-fibre which conducts such an impulse ends. If it ends in a gland, there will be secretion; if in the muscle, there will be contraction of that muscle. In cases, therefore, where the posterior division of the spinal nerve carries an outgoing impulse, since it ends in the muscles of the spine, there will be contraction of the muscles of the spine. This contraction will be on the same side as the sensory nerves irritated, and will affect that same spinal segment.

The Reflex Production of Vertebral Subluxation.— Physiologically, a muscle that is repeatedly stimulated by nerve-impulses finally reaches a condition of tetanic contraction. That is say, if the impulses are continuous, the muscle finally remains in a permanently contracted condition. This naturally holds true also of the muscles of the spine. If a continuous flow of violent outgoing impulses, as a result of repeated reflex acts, enter the muscles of a certain spinal segment, those muscles will become permanently contracted on the side affected. The muscles of the other side remain unaffected, or are affected in a much less degree.

The inevitable result of this contraction of the muscles of this side will be to draw the vertebra toward that side. The degree of displacement of the vertebra thus produced will depend upon the severity of the irritation which excites the afferent nerves concerned in the reflex act that causes contraction of the muscles of the involved segment. Since

the permanent contraction of the muscles necessary to the production of a vertebral subluxation depends upon repeated or marked stimulation, it follows that the exciting cause must be present for some time.

Returning to the example already cited, namely, the reflex contraction of the muscles of the intestines by irritation of their mucous lining in typhoid fever, we note the following: from what was said above, we know that the efferent impulses produced by the reflex act induced in this way will not only affect the muscles of the intestines but all other muscles supplied by the spinal nerve of the same segment at which the sensory nerve which was stimulated ends. Therefore, the muscles of the lower dorsal and upper lumbar segments of the spine will be contracted whenever the intestines are affected. As a result of this muscular contraction, there will be a subluxation of a vertebra in these regions. This is true because the sensory nerves of the intestines end in these segments of the spine.

Any disease which produces sufficient irritation at the periphery to stimulate the nerve-endings and produce a reflex act will, in the manner described, produce a subluxation in the same segment of the vertebral column whose muscles are innervated by efferent nerves from the corresponding segment of the spinal cord which receives the sensory nerves that have been stimulated.

That adjustment of these subluxated vertebrae favorably influences the condition which produced them, clinical evidence bears out. It is necessary to explain the exact manner in which this is brought about.

In the chapter dealing with the theoretical basis of chiropractic the statement was made, that the primary cause of a large number of diseases is subluxation of vertebrae. This is so by reason of the fact that as a result of subluxation the flow of those impulses essential to the normal functional activity and organic integrity of the various parts of the body supplied by the impinged nerves is prevented. The withdrawal of these necessary impulses creates in the parts thus deprived a condition which permits the development of pathological processes in them. That condition of the body, or any part of it, in which perfect innervation, and

consequently perfect function and organic integrity obtains, is known as "resistance." It is by virtue of this resistance that the development of disease processes is prevented. A lack of such resistance constitutes a condition permitting the development of disease processes.

It was stated that vertebral subluxations thus become in practically all cases the primary and predisposing cause of disease by producing the conditions which permit the development or continuance of a disease process. They are not, however, the direct cause of a disease, in all cases, and here we must differentiate carefully between the terms primary and direct, and the terms secondary and indirect. To do this, let us take as an example, typhoid fever.

The first question that naturally arises is: what is the primary cause of this disease, and what is the direct cause? The direct cause, in this case, is that factor which directly produces the disease, namely, the typhoid bacillus. This bacillus is not, however, the primary cause; for by this cause must be understood that state of condition of certain parts which makes the action of the typhoid bacillus possible. This primary cause is subluxation of vertebrae, which by producing a disturbed nerve-supply, and thereby diminishing the resistance of those parts for which the typhoid bacillus has a selective action, make possible their activity in those parts. Therefore the subluxations are the primary, indirect and predisposing cause of typhoid fever, and the typhoid bacillus is the secondary, exciting, and direct cause.

This statement is equivalent to saying that without a vertebral subluxation typhoid fever is impossible, and that is exactly what is meant. Why is it that of several people, all of whom are living under the same circumstances, exposed to identical conditions, eating and drinking the same food, etc., some will contract typhoid fever, and others go free? Evidently it must be because of differences in their susceptibility to the disease. We have seen that these differences in susceptibility depend upon the nature of the nerve-supply. And a normal nerve-supply depends upon a free and uninterrupted flow of impulses to those parts of the oody at which the typhoid bacillus gains entrance to the body.

If, therefore, the innervation of the intestines, which are the atrium of infection in typhoid fever, is abnormal, the disease will develop. Thus we see frequently that one individual who is apparently in perfect health develops typhoid, while another, whose general health is not nearly as perfect, goes free. This depends simply upon the fact that in the former the atrium of infection, namely, the intestine, was in a condition favorable to the entrance of the bacilli, while in the latter such conditions did not obtain.

This is true of all infectious and contagious diseases. What protects an individual against the development and continuance of a disease is not so much his general state of health, as the condition of the special area of predilection of the specific infection. Resistance as maintained by perfect innervation, therefore, prevents disease, and, conversely, lack of resistance induced by subluxation of the vertebrae permits disease.

To recapitulate: Vertebral subluxations are the primary predisposing and indirect factor in the production of many diseases, in which case they have pre-existed, and have been themselves previously produced by some external influence. They are, secondly, the cause of the continuance of a disease, having been reflexly caused by the disease itself. Vertebral subluxations, therefore, are the cause of the production and continuance of disease.

Spinal adjustment, by correcting these displacements of the vertebrae, accomplishes two things: (a) It removes the factor which makes it possible for a disease to gain entrance or a foothold in the body: (b) It restores normal nerve-impulses to parts deprived of them, and thus prevents the continuance of the disease.

CHAPTER V

The Local Effects of Vertebral Subluxation

It now remains to be shown what the immediate and remote effects of subluxations of vertebrae are. By the immediate effects are meant the influence upon the structures passing through the intervertebral foramen. By the remote effects are meant those which occur in the parts of the body supplied by the structures so influenced.

That subluxations sufficient to produce pressure upon the nerves and vessels passing through the intervertebral foramen may occur, and frequently do occur, has been demonstrated. That this pressure will prevent the conduction of the nerve-impulses which control the functional activity and the organic integrity of all parts of the body, has also been shown.

From the above, it can be readily deducted what the effects in any given case will be, once the subject of localization of segmental lesions is understood. Such special effects will be considered in detail further on. In this chapter we will confine ourselves to a discussion of the general effects of vertebral subluxations.

The Local Effects of Vertebral Subluxations.—When a vertebra becomes shifted from its normal position, its relative position to the vertebra above and below it is altered in all its parts. A change in the position of the margins of the intervertebral foramen occurs, and the displaced wall presses on the following structures which pass through the foramen:

Afferent and Efferent Spinal Nerves.

White and Gray Rami Communicantes of the Autonomic System.

Arteries and Veins.

Lymphatics.

Necessarily every structure that passes through the foramen is impinged, and we will now consider the general effects of pressure upon each of these structures.

Effect of Pressure on the Afferent Spinal Nerve.—The afferent fibres of the spinal nerve pass in the sheath of the spinal nerve to the cord. Here a reflex arc is established and impulses from the periphery are transferred to an outgoing fibre, and efferent impulses pass to the periphery. A vertebral subluxation will prevent the passage of the ingoing impulses to the cord, along the afferent nerves, and will therefore prevent the reflex act which occurs in the involved segment, under normal conditions, from taking place. As a result, the efferent impulses to the tissues supplied by that segment are not generated. As an example of this effect, we may consider the patellar reflex: If the afferent nerve is impinged at the intervertebral foramen, in the second lumbar segment, the knee-jerk will be absent.

Effect of Pressure on the Efferent Spinal Nerve.—An impingement on the efferent fibres of the spinal nerve will prevent the conduction of all outgoing impulses to the tissues supplied by the affected nerve. If, for example, the fourth cervical nerve is impinged, a poor quality of saliva is secreted and indigestion finally develops.

Effect of Pressure on the White Rami Communicantes.—It will be recalled that the white rami of the autonomic system pass through the intervertebral foramen in the sheath of the spinal nerve to the ganglia of the gangliated cord. They therefore are also impinged by subluxation of a vertebra. Their function, which is the conduction of efferent impulses from the brain and spinal cord to the ganglia, and thence to the various tissues, is interfered with. The action of the autonomic system is thus disturbed, and a lack of balance in the hamonious action of the various systems of the body ensues. These disturbances vary according to the segment of the spinal column which is involved, and will be considered later.

As an example of the results of pressure on the white rami we may assume that a subluxation exists at the fourth dorsal vertebra. This, by producing pressure on the spinal nerve, results in torpidity of the liver. The function of the liver is controlled especially by the autonomic system, and interference with the conduction of impulses to this organ invariably results in a disturbance of its function.

Effect of Pressure on the Gray Rami Communicantes.—The gray rami of the autonomic system pass to the spinal cord from the ganglia, in the sheath of the spinal nerve. Hence they also are subject to impingement when a vertebra becomes subluxated. These filaments govern the nutrition of each corresponding segment of the spinal cord, and complete the reflex arc through which the necessary efferent impulses are generated.

If, for example, the lower dorsal or upper lumbar vertebrae are subluxated, the afferent impulses are intercepted at this point. The intestinal tract is influenced by the white and gray rami in this region. Any change in the nature or amount of the intestinal contents excites an afferent impulse in the endings of the afferent nerves in the intestinal walls. When the reflex arc is intact, an efferent or motor impulse is generated, which is transmitted to the muscular coat of the intestines, causing them to evacuate their contents. If this reflex arc is not intact, in other words, if an impingement of the gray rami communicantes is present, the necessary efferent impulses which move the bowels to action is wanting. It is this act which operates in the production of constipation. It is for this reason that adjustment of the lower dorsal and upper lumbar vertebrae invariably relieves chronic constipation.

Effect of Pressure on the Arteries.—As previously shown, faulty nutrition of the nerve-centres, through deficient blood-supply, rapidly reduces their irritability. The arteries which pass through the intervertebral foramen in the sheath of the spinal nerve assist in supplying nourishment to the corresponding spinal segments. Impingement of these arteries reduces the blood-supply of this segment of the spinal cord. The effect of this is a diminution or total absence of irritability of that segment, and a consequent break in the reflex arc. As a result the nerve-supply of the parts controlled by this segment is not forthcoming and various disorders ensue.

As an example of the manner in which such a condition brings about abnormalities, the following may be cited: When the continuous flow of nerve-impulses is impeded, as it is in a case of this kind where the irritability of a spinal

segment is diminished, muscular tonicity will become abnormal. For example, a subluxation in the lumbar region, by producing an anemia of the spinal segment of the region involved, may cause the muscles and ligaments of the arch of the foot to become so relaxed that, with other factors entering, flat-foot may result.

Effect of Pressure on the Veins.—The veins which pass out through the intervertebral foramen, in the sheath of the spinal nerve, are also occluded when a subluxation exists. Since these veins convey the venous blood from each corresponding segment of the spinal cord, obstruction of the venous flow, by pressure upon the vein, will result in congestion of that segment.

Effect of Pressure on the Lymphatics.—The lymphatics which pass through the intervertebral foramina have much to do with the metabolism of each segment of the spinal cord. Any interference with this function, as a result of a subluxation obstructing the lymphatic channels, will alter the excitability of that segment, and the conduction of impulses, both afferent and efferent, is impaired.

CHAPTER VI

The Effect of Vertebral Subluxations on Nerve Function

The effects of vertebral subluxations on the function of nerves necessarily depend upon the location of the lesion to a large extent. These will be taken up in the chapter dealing with segmentation and localization. In this chapter the effects of vertebral subluxation on nerve functions in general will be considered, and examples illustrating each form of abnormal nerve action will be given. The reader is referred in this connection to the chapters dealing with the function of the nervous system, a thorough knowledge of which will make what follows clearer.

Effect of Vertebral Subluxations on Resistance.—We have fully explained how vertebral subluxations must be considered as being the primary and indirect cause of infectious and contagious diseases. Since normal innervation implies a perfect state of resistance, it follows that subluxations of vertebrae, by obstructing the flow of impulses to a part, diminish this resistance.

It has recently been conclusively shown that rheumatic fever is the result of the entrance of the infective organism through the tonsils. Diseased tonsils are an ideal culture medium for the growth and multiplication of these germs, and the elaboration of their toxins, which enter the body from this point. If, therefore, this atrium of infection is in such a state that it will not harbor these micro-organisms, but destroys them, rheumatic fever becomes impossible of development. A subluxation in the fifth and sixth cervical segments, however, markedly alters the normal condition of the tonsils, and they then become a favorable medium for the entrance of this specific infection. This same principle applies to all infections and contagious diseases.

Effect of Vertebral Subluxations on Movement and Sensibility.—The influence of the nerves upon movement and sensibility is well known. There is a constant flow of nerve-impluses which maintains the muscles of the entire body in

a state of slight continuous contraction. Every conscious and unconscious movement of any part of the body depends upon the contraction of a muscle, and this contraction depends upon an efferent impulse to the muscle.

As examples of interference with the motor function of nerves by mal-alignment of vertebrae may be cited the action of the heart, respiratory movements, the movements of the stomach and intestines, the production of secretion by the glands, etc. All these movements are controlled by certain nerves, and a subluxation, by interrupting the efferent impulses governing any of these motor actions, will result in abnormal function of the part involved. Thus a subluxation in the upper cervical and upper dorsal regions will interfere with the action of the heart. A subluxation in the fifth, sixth and seventh dorsal segments will interfere with the motility of the stomach, and result in indigestion. A subluxation in the lower dorsal and upper lumbar region of the vertebral column leads to insufficient intestinal peristalsis, and eventually produces constipation. A subluxation involving the fourth dorsal vertebra will result in various disorders of the liver. The etiological reason for this lies in the fact that from these segments of the cord rise the nerves which supply these various organs. A diagnosis of cardiac disturbances, gastric disorders, etc., can be made and confirmed by examining the spine and locating these subluxations. Naturally, it is impossible to determine from the spinal diagnosis the exact nature of the disorder, but that the disorder can be referred to a special organ, system or part of the body from the spinal analysis alone, can be demonstrated. The reason spinal adjustment produces desired results is simply because it restores to the affected parts the nerve-supply necessary to their motility upon which their normal functioning depends. Many of the internal viscera are supplied almost exclusively by the autonomic system, as is shown by the peculiarity in the mode of production of morbid conditions in them. If the body, for example, is exposed to cold and dampness, congestion of the kidneys, perhaps, is produced on the following day. Why not, until the next day, do these renal symptoms manifest themselves? Because as a result of the irritation of the

peripheral nerve-endings a reflex vertebral subluxation was produced in this particular individual in the tenth dorsal segment; this segment, governing the kidneys through the autonomic system, is no longer able to transmit impulses to the kidneys and disturbed circulation results. The reason that the symptoms do not follow until the day after exposure to the cause, is because the motor properties of the autonomic system are exercised slowly, as compared with those of the cerebrospinal, in which the effect of irritation of a motor nerve is instantaneous.

Effect of Vertebral Subluxations on Nutrition.—The effect of subluxations on the trophic function of nerves is very involved, since this term in its broadest sense includes the processes of digestion, respiration, absorption, secretion, excretion, anabolism, and catabolism. It is thus apparent that a great number of individual processes enter into the accomplishment of that single end, which we term nutrition. Since all these processes, which make the ultimate nutrition of the cells possible, are controlled by the nerves, subluxation of the vertebrae, by interfering with their normal exercise, causes disturbed nutrition. By some authorities it is claimed that there exist in all nerve bundles certain fibres which govern the nutrition of the parts to which these nerves go. If this is true, a subluxation of a vertebra would directly affect the trophic function of any part of the body supplied by that segment of the cord corresponding to the location of the subluxation.

The inhibitory and augmentor nerves are generally considered as having a trophic influence on the parts which they govern. That is to say, the nutrition of all parts is maintained by regulating their activity; during the period of inactivity, the building-up or anabolic processes take place. If, therefore, the cardio-inhibitory nerves are prevented from conducting their impulses to the heart muscle, its nutrition will suffer since its period of activity is in excess of its period of rest. Similarly the nutrition of every part of the body is governed by the harmonious action of the augmentor and inhibitory nerves. If a subluxation interferes with the conduction of the inhibitory impulses which retard or suspend the activity of an organ for a sufficient length of

time to permit the necessary reparative processes to take place, its nutrition will necessarily suffer.

Some writers contend that the spinal nerve sheath contains special trophic fibres and that certain diseases are due to impingement of only these fibres. This view is entirely erroneous, because it is inconceivable to suppose impingement of a single fibre even if individual trophic fibres exist, which is very doubtful.

Effect of Vertebral Subluxations on Secretion and Excretion.—The processes of secretion and excretion are controlled by the cerebrospinal and autonomic nerves, and are entirely involuntary. A subluxation, by interfering with the conductivity of the nerves, results in changes in the character of the secretion and interference with the functional activity of the organ affected.

As examples of such disturbances, the following may be cited: A subluxation of the fifth, sixth, or seventh dorsal vertebra may affect the secretion of the gastric juice, and thus lead to indigestion; a subluxation in the upper cervical region would also have such an effect. A subluxation in the upper cervical region, or affecting the fourth dorsal vertebra would cause a diminished secretion of bile.

A constant flow of efferent impulses also governs the secretory activity of certain glands, as those which have an internal secretion, for example, the thyroid gland and spleen. For this reason, subluxation of the sixth cervical vertebra results in a depraved action of the thyroid gland. In disorders of the spleen a subluxation of the ninth dorsal vertebra is very often found.

The effect of vertebral subluxations on the function of excretion is far-reaching in its effects. It is scarcely necessary to go into detail regarding the vast number of affections which may be traced to a perverted function of the excretory organs. The common condition, called autointoxication, is a very good example of this form of disturbance of nerve function.

The principle way in which subluxations of vertebrae affect the functions of secretion and excretion is by their influence in preventing the flow of efferent impulses to those organs concerned in these functions, by interrupting the mo-

tor impulses to the secretory cells. It must be borne in mind that nerves are identical and so also the impulse. The different action produced at their terminals depends upon the nature of the cells in which they terminate. If a nerve ends in a muscle, contraction of the muscle follows an efferent impulse to it. If it ends in a gland cell, the effect of an efferent impulse will be secretion or excretion. If, therefore, these efferent impulses are impeded, a deficient secretory activity, or excretory activity, will follow in those parts supplied by the affected nerve.

Effect of Vertebral Subluxations on Existing Action.—Subluxations by cutting off the necessary impulses to a part or organ of the body may cause it to become overactive. On the other hand, it may cause a decreased activity of a part.

This is well illustrated by the inhibitory action of the vagus upon the activity of the heart. Since the vagus is connected with the superior cervical ganglion of the autonomic system, it may be influenced through the upper cervical vertebrae. A subluxation in that region of the spine is therefore influential in producing a rapid action of the heart by interfering with the inhibitory action of the vagus upon it.

Effect of Vertebral Subluxations on Temperature.—The amount of heat produced in the body varies with the metabolism of the tissues of the body. The amount of heat lost by the body depends upon the radiation and conduction of heat from its surface, evaporation of water, respiration, etc. The normal temperature of the body is maintained under the varying conditions to which the body is exposed by mechanisms which permit variation in the production of heat, and variation in the loss of heat. Thus in normal individuals the loss and gain of heat are so well balanced that a uniform temperature is maintained.

The influence of the nervous system on the regulation of temperature is very great. The nervous system, by governing metabolism, controls the temperature of the body. By its vaso-motor influence, regulating the calibre of the blood-vessels and consequently the circulation, it also regulates the temperature. In addition to these methods of regulation

of the temperature by the nerves, there is a separate nervous apparatus by means of which heat production and heat loss are regulated as circumstances demand. This apparatus, as mentioned in the discussion of this subject under the head of the physiology of the nervous system, consists of centres which may be reflexly stimulated by afferent impulses from the skin, and which act through special efferent nerves supplying the various tissues. Any disturbance of this reflex arc will produce an abnormal temperature.

So long as the skin is able to communicate to the nervous centres the necessity of an increased or diminished production of heat, normal bodily temperature exists. In fever, then, there must be some interference in the ordinary channel by which the skin is able to communicate to the nerve centres this necessity. The only logical place at which such an interference with the afferent impulses could occur is at the intervertebral foramina.

It is not meant to be understood that a subluxation in any region of the vertebral column will cause a rise of the body temperature. The change in the temperature, whether it be higher than normal, or subnormal, is limited to the region of the body supplied by the spinal segment which is involved, and in which the reflex arc is interrupted. Subluxations may, however, produce a rise in the general body temperature by lowering the resistance of a certain part of the body and thus making it a favorable culture medium for the multiplication of germs and the elaboration of their toxins. In this connection it must be borne in mind that in any infectious disease it is not the germs which produce the fever, but the circulation in the blood of their toxins. It is for this reason, that in typhoid fever, for example, the fever is so rapidly reduced by adjustment of the segments which control the intestines and spleen. These parts form the point of predilection of the typhoid bacilli, and when their resistance is restored to a normal degree, the further formation of toxins by the bacilli is prevented, and the fever subsides.

Subluxations in the upper cervical region may also directly influence the general body temperature, by disturbing the excitability of the reflex heat centre in the medulla.

Thus fever is very often reduced simply by an adjustment of the atlas.

Effect of Vertebral Subluxations on Metabolism.—Something has already been said of the effect of subluxation of vertebrae on metabolism in connection with their effect on nutrition. As a matter of fact, the effect of subluxations on metabolism is so closely interwoven with all the other disturbances of nerve action that discussion of it enters into all their effects on other functions of the nerves.

Subluxations, especially by preventing the conduction of the impulses from the autonomic nerves, cause a disturbance in metabolism. When the metabolism of a part is disturbed, its functional activity necessarily suffers. Thus when the autonomic nerve-supply to a gland is withdrawn, by a subluxation in the segment which governs it, the secretion from this gland will be very much less rich in its essential constituents. In this manner, a subluxation in the segment controlling the liver may lead to numerous disorders as a result of the functional inactivity of that organ, with a consequent diminished flow of bile. Also a subluxation in the segment governing the pancreas may produce a total cessation of its secretory activity, and lead to diabetes, which is generally classed among the diseases of metabolism. In like manner all the many diseases of metabolism may be traced to subluxation of certain vertebrae.

Effect of Vertebral Subluxations on Circulation.—The connection between subluxations and the circulation of the blood is exceedingly close. Physiological experiments show that pressure upon the autonomic nerves sufficient to prevent the conduction of their efferent impulses will produce vascular congestion of the parts supplied by them. This is exactly what occurs when, as a result of a subluxation, the margins of the intervertebral foramina press upon the white rami communicantes.

As an example of the results of the effects of vertebral subluxations on the circulation the following may be cited: The superior cervical ganglion of the autonomic system governs the circulation of the blood to the cranium. A subluxation in this region of the vertebral column will therefore very frequently produce cerebral congestion. In like man-

ner congestion in any part of the body is induced by a subluxation affecting the segment controlling such a part. The disturbances in the functional activity and organic integrity of parts so affected are very numerous, and all respond to adjustment of the subluxation.

Effect of Vertebral Subluxations on the Organs.—Aside from the derangements produced in the organs by subluxations influencing their functional activity indirectly, they are also influenced directly. This is true for the reason that the autonomic system has an action entirely independent of the cerebrospinal system in those organs in which terminal ganglia are located.

Thus a subluxation of any of the upper cervical vertebrae will directly influence the action of the heart. This is brought about as follows: The displaced vertebra, by producing pressure upon the rami to the cervical ganglia, prevents the condition of impulses to the cardiac ganglia and disturbed action of the heart follows. Again, subluxations in the mid-dorsal region cause disturbances of the stomach, by a similar effect upon the splanchnics.

Effect of Vertebral Subluxations on Reflex Action.—Reflex actions which are performed in health have a distinct purpose, and are adapted to producing some end which is desirable and necessary for the well-being of the body. All reflex actions are motor, and depend upon the unimpeded conductivity of the nerves involved in the action. Thus pressure upon the afferent and efferent nerves consequent upon a vertebral subluxation prevents the conduction of the impulses from the periphery to the spinal centre, or the conduction of the outgoing impulses from the spinal centre to the part for which they are destined.

For example, it is through the afferent impulses excited in the wall of the bowel that the centre in the spinal cord regulating the movement of their muscular coat sends out impulses producing this movement. If, however, a subluxation exists in the lower dorsal or upper lumbar region of the spinal column, the reflex arc is broken, and the impulses which are reflexly produced as a result of the stimulation in the wall of the bowel, never reach its musculature. As

a consequence of this lack of muscular action, constipation results.

Another example of the reflex action being interrupted is that in which secretion is stopped as a result of it. Thus if the impulses which are sent to the stomach, producing the secretion of gastric juice when food enters it, are prevented from reaching it as a result of a subluxation, indigestion will follow.

Effect of Vertebral Subluxations on the Cranial Nerve Functions.—Subluxations in the upper cervical region, and of any of the upper six dorsal vertebrae will affect the function of the cranial nerves. The manner in which this is brought about is as follows: All anatomists are agreed that the gray rami communicantes of the superior cervical ganglion of the gangliated cord communicate with all the cranial nerves. Some of the fibres of the gray rami pass to the origin of the cranial nerves in the brain, while others accompany the nerves throughout their distribution. Since the superior cervical ganglion connects with the first four spinal nerves through the medium of both gray and white rami, the cranial nerves communicate directly with these spinal nerves. Impulses, therefore, which pass through the spinal nerves, through the rami communicantes, to the cranial nerves may thus be interrupted by impingement of the first four spinal nerves. Reference to the chapter dealing with the connection between the autonomic system and the cranial nerves will give the reader an exact idea of how vertebral subluxations may influence individual cranial nerves in any given case.

As an example of the influence of subluxations on the action of the cranial nerves, we will consider the disturbances of the third cranial nerve as a result of a break in the continuity of the reflex arc. As is well known, perfect vision depends partly upon the power of accommodation, as regulated by the proper contraction and dilatation of the pupil. The pupillary reflex is governed by the motor oculi, or third cranial nerve. Having reached the cilio-spinal centres in the cord, from the brain, the optic impulses take one of two possible courses: They leave the cord through the anterior roots of the upper thoracic nerves and run, in

succession, through the rami communicantes, the cervical portion of the gangliated cord of the autonomic, the cavernous plexus, the ciliary ganglion and the short ciliary nerves to the radiating fibres of the iris, producing dilatation of the pupil. It can be readily appreciated what would happen to these impulses were the power of conduction of the upper dorsal spinal nerves to be destroyed by pressure upon them of the misplaced margins of one of the intervertebral foramina in this region. The contraction of the pupil is prevented in the same manner.

In this way, by tracing the nerve-supply of any part having connection with the cranial nerves, the effects of a vertebral subluxation upon the function of that nerve may be readily determined.

SECTION FIVE

Spinal Analysis

CHAPTER I

Segmentation and Localization

The first requisite to a scientific application of spinal analysis is a knowledge of the vertebral column as a whole, and of the various groups of vertebrae which comprise it, together with their ligaments. The next essential is an exact knowledge of the segmentation of the spine and of the point of emergence of the spinal nerves.

The Vertebral Column.—The spine is a flexible and flexuous column composed of a series of bones, called vertebrae (from *vertere,* to turn). There are 33 vertebrae, divided into five groups, and named according to the region which they occupy, as, 7 cervical (in the neck), 12 thoracic (at the level of the thorax), 5 lumbar (at the level of the abdomen), 5 sacral (at the level of the pelvis), and 4 coccygeal (forming the coccyx). Those of the upper three regions, namely the first twenty-four vertebrae, are separate throughout life, and are known as movable or true vertebrae. The succeeding five, or sacral, become united in the adult to form the sacrum, and the last four, or coccygeal, unite to form the tip of the spine, or coccyx; these lower nine vertebrae are accordingly called fixed or false vertebrae, since they have no mobility and are not individual bones.

Although the vertebrae differ markedly in some respects, each vertebra is constructed on a common plan, which is more or less modified in different regions to meet special requirements. Thus each vertebra consists of two parts, a solid part, or body, in front, and a circular part, or arch, behind. The bodies are set one upon the other, forming a strong pillar to support the head and trunk; the arches also set one upon the other and form a cylinder which contains

the spinal cord. Between the bodies there are placed cushion-like pads of cartilage which prevent jarring and act in the same capacity that the cartilaginous covering of the articular ends of all bones do, namely prevent friction between the bones and promote the greatest freedom of movement. Each arch contains a notch on its upper and lower surface, and when these are united with the corresponding ones above and below, circular openings are formed through which the spinal nerves pass outward.

The body, or centrum, is a solid disc of bone, about three-fourths of an inch in thickness and from one to two inches in diameter. It is convex in front, and concave behind, from side to side. It is concave from above downward in front, and nearly flat behind. Its anterior surface is perforated by a few small openings for the entrance of nutrient vessels; its posterior surface has one large opening for the exit of the vein.

The intervertebral cartilaginous discs are placed between the bodies of the vertebrae, whose upper and lower surfaces are slightly concave and rough for their attachment.

The pedicles are two short, thick pieces of bone which project backward from the upper and outer corner of the posterior aspect of the body. Upon the upper and lower surfaces of these are located the notches whose union forms the intervertebral foramina.

The laminae are two broad, flat, sloping plates, joined to the pedicles on each side, and, passing backward, are joined to each other behind. They complete the foramen which encloses and protects the spinal cord, and which is termed the spinal foramen. Their borders are rough for the attachment of the ligamenta flava.

The spinous process projects backward from the junction of the two laminae and serves for the attachment of muscles and ligaments. Palpation of these processes is used to determine from their relation to each other if there is any displacement of the vertebrae.

The transverse processes, two in number, project outward at each side from the junction of the pedicles and laminae. They also serve for the attachment of muscles and ligaments. These processes are of even greater im-

portance than the spinous process in determining the existence of a subluxation and its character.

The articular processes, two on each side, namely, the superior and inferior, project upward and downward from the junction of the laminae and pedicles. Their surfaces are smooth, and when the vertebrae are joined, they articulate with the ones above and below.

Let us next consider the special characteristics of the vertebrae of each region of the spinal column, as these factors have an important bearing on the possible varieties of subluxations of the vertebrae of each region.

The Cervical Vertebrae.—The body of these vertebrae is small, and broader from side to side than from before backward. The anterior and posterior surfaces are flattened and of equal depth. Its upper surface is concave transversely, and has a projecting lip on each side; its lower surface is convex transversely, and has a shallow groove on each side which receives the lip of the vertebra below. The pedicles are directed outward and backward, and spring from the body about midway between the upper and lower borders. The superior and inferior notches are nearly equal in depth, though the inferior are generally somewhat deeper. The laminae are long and narrow, and overlap each other behind; they enclose the spinal foramen which is very large and of triangular form. The spinous process is short, and its extremity bifid. The articular processes are situated at the junction of the laminae and pedicles, and are obliquely placed, and their surface is flat. The superior projects backward and upward, the inferior forward and downward.

The Thoracic Vertebrae.—The body of these vertebrae is heart-shaped, and as broad from before backward as from side to side. It is thicker behind than in front, which produces the curve of the spinal column in the thoracic region. The upper and lower surfaces are flat; it is convex in front, and deeply concave behind. On each side of the body where it joins the arch are placed two semilunar depressions; these unite with the ones above and below to form complete articular facets for the heads of the ribs. The upper and lower thoracic vertebrae somewhat resemble the cervical and lumbar vertebrae respectively. The pedicles are directed back-

ward, and the intervertebral notches on their under surface are large and deeper than in any other region of the spine. The laminae are broad and thick, and overlap each other. The spinal foramen is small and circular. The spinous process is long, three-sided, and directed obliquely downward; they overlap each other especially from the fifth to the eighth. The articular processes project from the upper and lower surfaces of the pedicles; their surfaces are placed nearly vertical, and are flat; the superior is directed downward and upward, the inferior, forward and downward. The transverse processes are thick, strong, of great length, and directed obliquely backward and outward; their end is clubbed and tipped with a small concave surface for articulation with the tubercle of a rib.

The Lumbar Vertebrae.—The body of these vertebrae is large, kidney-shaped, and slightly thicker in front than behind, which forms the lumbar curve of the spine. The pedicles are very strong, and extend directly backward from the upper part of the body, which makes the intervertebral notches very deep. The laminae are broad, short, and strong. The spinal foramen is triangular; it is larger than in the thoracic, and smaller than in the cervical region. The spinous processes are thick, broad, quadrilateral, and horizontal in direction; they are thicker below than above, and end in a rough, uneven border. The articular processes are thick and strong; the superior are concave, and look backward and inward; the inferior are convex, and look forward and outward. The transverse processes are long, slender, and spatula-shaped; they are directed transversely outward in the upper three lumbar vertebrae, and slant a little upward in the lower two.

The Normal Curves of the Spine.—As a further assistant to the making of a correct spinal analysis a knowledge of the curves of the spine is very useful.

When the spine is viewed from the side, it will be noted that there are four curves; that in the cervical region, in which the convexity is anteriorly directed; that in the thoracic region, in which the convexity is posteriorly directed; that in the lumbar region, in which the convexity is

again directed anteriorly; lastly, the sacral curve the convexity of which is directed backward.

The curves vary in different individuals, and also according to age, sex, occupation, etc. A difference in the curves is also noted at different times of the day, owing to the compression of the discs due to the upright posture. It is very important to determine any abnormality of these curves, from the standpoint of spinal adjustment, and this will be considered in detail further on.

The twenty-three intervertebral discs between the bodies of the vertebrae tend to give the spine as a whole its great flexibility; the muscles and ligaments attached to its surfaces and processes also assist in this, and are important factors in maintaining its normal poise and preventing subluxations. By viewing the spinal column anteriorly, it will be noted that the extremities of the transverse processes of the atlas extend laterally to about the same distance as those of the first thoracic vertebra. The transverse processes of the other cervical vertebrae are rudimentary, and increase in length in proportion to the increase in the width of the bodies, until the first thoracic vertebra is reached. The transverse processes gradually decrease in length from this point to the twelfth thoracic vertebra. In the lumbar region, the transverse processes of the first lumbar vertebra extend laterally further than those of the first thoracic; those of the second lumbar are longer than those of the first; those of the third are longer than those of the second. From this point diminution in length again is noted, the fourth corresponding to the first, and the fifth to the second lumbar vertebra.

Movements of the Spine.—It will be noted, in considering the movements of the spine, that in the adult a little more than one-fifth of this movement occurs in the neck, and that a little less than one-third of this movement occurs in the lumbar region. Various peculiarities of the vertebrae in the different regions of the spinal column modify the degree of motion of the spine as a whole. Thus the differences in the thickness of the discs, the vertical measurements of the bodies, and the fact that the bodies are not perfectly circular modify the movements of the spine in certain

regions. The shape and placement of the articular processes also influence the degree of certain movements in various regions of the spine. In the dorsal region, the attachment of the ribs to the bodies of the vertebrae also makes some movements more restricted than in other regions. The ligaments of the spine also have a tendency, when perfect balance exists on both sides, to limit the degree of movement of the spine, when excessive, by the tension which is produced in the ligaments on the side of the bodies opposite to the direction of the motion. The resistance to compression of that side of the intervertebral disc toward which the motion occurs also tends to limit any excessive movement of the vertebrae.

The amount of all movements of the spine varies in different individuals, and as age advances there is a progressive decrease in the limits of mobility of the vertebral column. This is simply due to the varying degrees of elasticity of the parts involved.

The movements of which the spine is capable are:

1. Flexion.
2. Extension.
3. Rotation.
4. Lateral motion.
5. Mixed motion.

Flexion, or forward bending, is more free in the cervical region than extension, which is limited by the locking of the laminae when the head is thrown back as far as possible. In the lower thoracic and lumbar regions flexion is comparatively free. Before the consolidation of the spine, flexion of a slight degree is possible throughout the vertebral column.

Extension in the neck is limited by the locking of the laminae. In the other regions of the spine it is speedily checked by the locking of the laminae and spinous processes; this movement is chiefly limited to the last two thoracic and the lumbar vertebrae.

Lateral movement is greatest in the cervical region, followed by that of the thoracic and lumbar regions.

Rotation is freest in the cervical region, considerable in the thoracic region, and least in the lumbar region.

Mixed movements are combinations of any of the above movements. Thus lateral movement is nearly always associated with rotation.

Position of the Vertebrae.—As a further means of assistance in the making of a correct spinal analysis the location of the various vertebrae is very essential. The following are the surface landmarks of the different vertebrae:

1st Cervical: This vertebra has no spinous process, and the posterior arch is between the occiput and the spine of the axis. The transverse processes are just below and in front of the tips of the mastoid processes.

2nd Cervical: This vertebra is most easily recognized as being the first spinous process below the occiput.

3rd Cervical: The spinous process of this vertebra is very difficult to palpate, since it lies beneath the overlapping spinous process of the axis, and can only be felt when the neck is flexed. It is the second below the occiput.

4th Cervical: The spinous process of this vertebra is the third one palpated when the neck is flexed. This vertebra is opposite the hyoid bone.

5th Cervical: This vertebra is recognized as being the fourth palpated when the neck is flexed.

6th Cervical: This vertebra is on a line with the cricoid cartilage. Its spinous process is directly above that of the vertebra prominens.

7th Cervical: This vertebra is easily recognized by the great length of its spinous process, which is used as a landmark in counting the spinous processes upward and downward.

1st Thoracic: The spinous process of this vertebra is on a line with the superior portion of the spine of the scapula, and is detected by placing the thumbs on the spinous process which is on a line with the fingers placed on the superior surface of the spines of the scapulae.

2nd Thoracic: The spinous process of this vertebra corresponds to head of the third rib. It is located by noting it as being the first one below the first thoracic.

3rd Thoracic: The spinous process of this vertebra is on a line with the inner edge of the spine of the scapula. It is the second spinous process below the first thoracic.

4th Thoracic: The spinous process of this vertebra is opposite the junction of the first and second parts of the sternum. It is located by counting downward from the first thoracic, or upward from the seventh thoracic spine.

5th Thoracic: The spinous process of this vertebra is most easily determined by counting upward from the seventh.

6th Thoracic: The spinous process of this vertebra is directly above that of the seventh.

7th Thoracic: The spinous process of this vertebra corresponds to the inferior angle of the scapula when the subject is sitting with the arms hanging at the sides, and half an inch above when the subject is lying prone. It is located by placing the thumb on a line with the finger placed on the inferior angle of the scapula.

8th Thoracic: The spinous process of this vertebra is most readily located by determining the position of the seventh and then palpating the one below it.

9th Thoracic: The spinous process of this vertebra is also most easily determined by first noting the position of the seventh, and then counting downward from this point.

10th Thoracic: The spinous process of this vertebra corresponds to the level of the ensiform cartilage of the sternum. It is located about half an inch below the attachment of the tenth rib, which is followed from its prominence to the spine.

11th Thoracic: The spinous process of this vertebra is best located by first determining the position of the tenth thoracic vertebra.

12th Thoracic: The spinous process of this vertebra corresponds to the head of the last rib. It is located either by counting downward from the seventh or the tenth thoracic spinous process.

1st Lumbar: The spinous process of this vertebra is most easily recognized by an upward count from the fourth lumbar spinous process.

2nd Lumbar: The spinous process of this vertebra is also most readily located by counting upward from the spine of the fourth lumbar.

3rd Lumbar: The spinous process of this vertebra like

the first and second is determined by counting upward from the fourth, being directly above that vertebra.

4th Lumbar: The spinous process of this vertebra is situated at the level of a line drawn between the iliac crests. It is located by palpating the sacrum and fifth lumbar which are immediately below it, or by placing the thumbs midway between the fingers placed upon the crests of the ilia on both sides.

5th Lumbar: The spinous process of this vertebra is located below that of the fourth lumbar vertebra and above the sacrum.

Tabulated Attachment of Spinal Nerves to Cord.—The following table by Reid gives the topography of the attachment of the spinal nerves to the cord: A marking the highest and B the lowest level. A thorough study of this table will aid the reader in segment localization.

NERVES:

1st Cervical connects opposite superior margin of Foramen Magnum and just below the inferior margin.

2nd Cervical: (A) A little above posterior arch of atlas.

2nd Cervical: (B) Midway between the posterior arch of atlas and spine of axis.

3rd Cervical: (A) A little below posterior arch of atlas.

3rd Cervical: (B) Junction of upper two-thirds and lower third of spine of axis.

4th Cervical: (A) Just below upper border of spine of axis.

4th Cervical: (B) Middle of spine of third cervical vertebra.

5th Cervical: (A) Just below the lower border of spine of axis.

5th Cervical: (B) Just below lower border of spine of fourth cervical.

6th Cervical: (A) Lower border of spine of third cervical vertebra.

6th Cervical: (B) Lower border of spine of fifth cervical vertebra.

7th Cervical: (A) Just below upper border of spine of fourth cervical vertebra.

7th Cervical: (B) Just above lower border of spine of sixth cervical vertebra.

8th Cervical: (A) Upper border of spine of fifth cervical vertebra.

8th Cervical: (B) Upper border of spine of seventh cervical vertebra.

1st Thoracic: (A) Midway between spines of fifth cervical and sixth cervical vertebrae.

1st Thoracic: (B) Junction of upper two-thirds and lower third of interval between seventh cervical and first thoracic.

2nd Thoracic: (A) Lower border of spine of sixth cervical vertebra.

2nd Thoracic: (B) Just above lower border of spine of first thoracic.

3rd Thoracic: (A) Just above middle of spine of seventh cervical vertebra.

3rd Thoracic: (B) Lower border of spine of second thoracic vertebra.

4th Thoracic: (A) Just below upper border of spine of first thoracic.

4th Thoracic: (B) Junction of upper third and lower two-thirds of spine of third thoracic vertebra.

5th Thoracic: (A) Upper border of spine of second thoracic vertebra.

5th Thoracic: (B) Junction of upper quarter and lower three-quarters of spine of fourth thoracic vertebra.

6th Thoracic: (A) Lower border of spine of second thoracic vertebra.

6th Thoracic: (B) Just below upper border of spine of fifth thoracic.

7th Thoracic: (A) Junction of upper third and lower two-thirds of spine of fourth thoracic vertebra.

7th Thoracic: (B) Just above lower border of fifth thoracic.

8th Thoracic: (A) Junction of upper two-thirds and lower third of interval between spines of fourth thoracic and fifth thoracic vertebrae.

8th Thoracic: (B) Junction of upper quarter and lower three-quarters of spine of sixth thoracic vertebra.

9th Thoracic: (A) Midway between spines of fifth thoracic and sixth thoracic vertebrae.

9th Thoracic: (B) Upper border of spine of seventh thoracic vertebra.

10th Thoracic: (A) Midway between spines of sixth and seventh thoracic vertebra.

10th Thoracic: (B) Middle of spine of eighth thoracic vertebra.

11th Thoracic: (A) Junction of upper quarter and lower three-quarters of spine of seventh thoracic.

12th Thoracic: (B) Just below spine of ninth thoracic vertebra.

1st Lumbar: (A) Midway between spines of eighth thoracic and ninth thoracic vertebra.

1st Lumbar: (B) Lower border of spine of tenth thoracic vertebra.

2nd Lumbar: (A) Middle of spine of ninth thoracic vertebra.

2nd Lumbar: (B) Junction of upper third and lower two-thirds of spine of eleventh thoracic vertebra.

3rd Lumbar: (A) Middle of spine of tenth thoracic vertebra.

3rd Lumbar: (B) Just below spine of eleventh thoracic.

4th Lumbar: (A) Just below spine of tenth thoracic vertebra.

4th Lumbar: (B) Junction of upper quarter and lower three-quarters of spine of twelfth thoracic vertebra.

5th Lumbar: (A) Junction of upper third and lower two-thirds of spine of eleventh thoracic vertebra.

5th Lumbar: (B) Middle of spine of twelfth thoracic vertebra.

1st Sacral to 5th Sacral: (A) Just above lower border of spine of eleventh thoracic vertebra.

1st Sacral to 5th Sacral: (B) Lower border of spine of first lumbar vertebra.

Coccygeal: (A) Lower border of spine of first lumbar vertebra.

Coccygeal: (B) Just below upper border of spine of second lumbar vertebra.

The Exit of the Spinal Nerves in Respect to the Spinous Processes.—The following table gives the surface markings of the emergence of the spinal nerves from the intervertebral foramina, in respect to the spinous processes; the roots of the spinal nerves from their origin in the cord run obliquely downward to their point of exit from the intervertebral foramina, the amount of obliquity varying in different regions of the spine, and being greater in the lower than upper part. Thus the level of their emergence from the intervertebral foramina does not correspond to the point of emergence of the nerve from the cord. For example, the ninth thoracic nerve emerges from the cord at the level of the seventh thoracic spinous process, while the level of its emergence from the intervertebral foramen is at the eighth thoracic spinous process. In the preceding table the relation between the emergence from the cord and the spinous processes was given; in the following table the relation of the exit of the spinal nerves from the intervertebral foramina to the spinous processes will be shown.

Spinal Nerve	Level of Emergence
C I	Between occiput and spine of axis.
C II	Middle of spine of axis.
C III	End of spine of axis.
C IV	Spine of third cervical vertebra.
C V	Spine of fourth cervical vertebra.
C VI	Spine of fifth cervical vertebra.
C VII	Spine of sixth cervical vertebra.
C VIII	Spine of vertebra prominens.
D I	Between seventh cervical and first dorsal spines.
D II	Between spines of first and second dorsal vertebrae.
D III	Between spines of second and third dorsal vertebrae.
D IV	Spine of third dorsal vertebra.
D V	Spine of fourth dorsal vertebra.
D VI	Spine of fifth dorsal vertebra.
D VII	Between spines of fifth and sixth dorsal vertebrae.

Spinal Nerve	Level of Emergence
D VIII	Between spines of sixth and seventh dorsal vertebrae.
D IX	Spine of seventh dorsal vertebra.
D X	Spine of eighth dorsal vertebra.
D XI	Between spines of ninth and tenth dorsal vertebrae.
D XII	Spine of eleventh dorsal vertebra.
L I	Spine of twelfth dorsal vertebra.
L II	Between spines of first and second lumbar vertebrae.
L III	Spine of third lumbar vertebra.
L IV	Spine of fourth lumbar vertebra.
L V	Spine of fifth lumbar vertebra.

Segmental Localization.—"A spinal segment is that part of the cord contained between two sets of roots. Each segment must be regarded as a unit endowed with motor, sensory, trophic, vasomotor, and reflex functions in respect to the parts supplied by the roots of the nerves which emerge from and enter it. A segment is named from the nerve-roots which take their origin from it, and not from the vertebra with which it corresponds." (Abrams.)

The following table, by Sherrington, slightly modified, shows the different segments and the various parts which they control. This table is compiled from data collected from sources both clinical and experimental; the latter are distinguished by being printed in italics, and rest on observations obtained chiefly from the dog and monkey.

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
C I.		No afferent root usually present.			Just above arch of atlas.
C II.	*Side of head from mid-line of scalp to mid-line under mouth behind chin. Ant. border lies about midway between root of pinna and outer angle of orbit, and about midway between hind edge of ascend. ramus of lower jaw and angle of mouth. Post. border from below external occipit. protub. runs well behind pinna, to the cricoid cartilage.*	Same as motor.	Same as motor.	*Drawing up of shoulder, down of head to same side; turning of chin toward oppos. shoulder with the neck.*	Ranges from just above to just below spine of atlas.
C III.	From mid-scalp little behind halfway between top of occiput and ext. occipt. protub. the ant. border runs behind pinna and post. edge of low. jaw to reach the thyroid cartilage. The post. border passes from the mid-dorsal line of neck below level of fourth cervical spine and slopes to root of acromion, turns and forms a characteristic notch, then crosses chest below clavicle to reach sternum at second costal cartilage.	Same as motor.	Same as motor.	*Elevation of shoulder, drawing down of head to same side; flexion of elbow feeble and occasional.*	At or a little above the spine of the axis.
C IV.	*Ant. edge runs from just above exter. occipit. protuberance outward close behind root of pinna and well behind angle of jaw to reach below cricoid. Post. edge runs from mid-line of back on level with top of scapula, slopes over root of scapular spine, crosses infra-spinous fossa to leave mid-way between acromian and inferior angle, winds halfway down upper arm, turns upon coracobrachialis over pectoral fold to pass well above the nipple to third cost. cart.*	Same as motor.	Same as motor.	*Retraction of shoulder, sometimes lifting of shoulder with protraction; flexion at elbow, but not invariably; lateral flexion of neck; occasionally flexion adduction of thumb.*	Ranges from spine of axis to spine of third cervical vertebra.

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
Rectus cap. post. maj. et. min. Obliq. cap. sup. et inf., Trapezius, Sternomastoid, Sternohyoid, Sternothyroid, Omohyoid (esp. ant. belly), Rectus later., Rectus cap. ant. min., Geniohyoid, Thyrohyoid (?Complexus).	*Lateral flexion of head and neck toward the side stimulated, without rotation of the head.*	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.
Rectus cap. ant. maj., Longus colli, Sternomastoid, Geniohyoid, Sternohyoid, Sternothyroid, Thyrohyoid, Omohyoid (espec. post. belly) Cervicalis ascendens, Trapezius, Complexus, Obliquus inf., Trachelomastoid.	*Lateral flexion of the neck to the side stimulated, with some retraction; little or no rotation of the head, but the chin may be turned slightly toward opposite side.*	ditto	ditto
Rectus cap. ant. maj., Longus, colli, Levat. ang. scap., Omohyoid (post. belly), Sternohyoid (lower part), Complexus, Splenius, Trachelomastoid, Trapezius, Cervicalis ascendens, Transversi spinales (?Sternomastoid Diaphragm).	*Lateral flexion of the neck toward the side stimulated, with marked retraction and a little turning of the neck, so that chin is thrust up to opposite side.*	ditto	ditto
Levator scapulæ, Longus colli, Scalenus med., Trapezius Subclavius, Diaphragm (front or sternal portion), Complexus, Splenius, Trachelomastoid, Cervicalis ascendens, Transversospinales (?Scalenus anticus).	*Elevation of shoulder, dragging it headward and toward spinal column; slight lateral flexion toward side stimulated with marked retraction. With shoulder fixed the turning of the head toward opposite side is more marked.*	ditto	ditto

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
C V.	*Ant. border, from near spine of third cerv. vert., passes down to outer third of clavicle and along it, runs inward to mid-line of chest. Post. border, from below spine of seventh cerv. vert., sweeps outward over base of spine of scapula, enters arm below and behind deltoid, gets on to supinator longus and recurves on that nearly halfway down forearm; crosses the chest two fingers' breadths above nipple on the third cost. cart.*	Same as motor.	Same as motor.	*Flexion at elbow; movement at shoulder, sometimes retraction, sometimes elevation; adduction and flexion of thumb; occasionally simple adduction at shoulder.*	Ranges from lower edge of spine of axis to that of fourth cerv. vertebra.
C VI.	*A long field occupying the outer and radial aspect of the arm from just below the deltoid insertion above to the thumb below, and nowhere reaching the chest or trunk. Sometimes more or less of the index finger is included; sometimes, however, the field does not come down to as far as the styloid process of the radius.*	Same as motor.	Same as motor.	*Flexion at elbow; adduction and flexion of thumb; flexion of other digits; retraction of shoulder.*	Ranges from lower edge of spine of third to that of fifth cervical vertebra.
C VII.	*The outer (radial) side of lowest third of upper and of whole of forearm and hand, including all the fingers except the minimus and ulnar side of ring finger.*	Same as motor. Triceps tap.	Same as motor. Triceps tap.	*Adduction and flexion of thumb, and flexion of other digits; flexion at elbow; retraction at shoulder.* Periosteal reflex of radius and ulna (Starr, Goldscheider.)	Ranges between top of fourth and bottom of sixth spinous process.

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
Levator ang. scap., Longus colli, Erector spinæ, Transversospinales, Rhomboid, Subclavius, Diaphragm, Serratus magnus, Scalen. med., Deltoideus, Teres minor, Subscapularis, Supraspinatus, Infraspinatus, Pectoralis maj. (clavicular portion), Biceps, Brachialis ant., Coracobrach., *Ext. carpi rad. long., Supinator longus, in Macacus.*	*Elevation, abduction, and some outward rotation of shoulder; flexion at elbow, wrist being slightly supinated; slight radial abduction at wrist; slight lateral flexion of neck with some retraction of head toward side stimulated.*	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.
Longus colli, Erector spinæ, Transversospinales, Rhomboids, Diaphragm, Subclavius, Serratus magnus, Scaleni, Deltoid, Teres minor, Teres major, Subscapularis, Supraspinatus, Infraspinatus Pectoralis major (clavicular head), Latissimus dorsi, Biceps, Brachial-anticus, Coracobrachialis, Triceps (outer and long head), Ext. carpi rad. long. et brevior, Pronator teres, Supinator long. et brevis., Flexor carpi radialis, Flexor carpi ulnaris (feeble), *Extensor communis digitorum, in Macacus.*	*Moderate adduction of shoulder; at elbow strong flexion; some supination of wrist, slight extension of wrist in most individuals, but in others flexion at wrist; slight extension of digits in most individuals; slight lateral flexion of head to side stimulated, with slight retraction of head.*	ditto	ditto
Longus colli, Erector spinæ, Transversospinales, Scaleni, Serratus magnus, Deltoid (from spine of scapula), Teres maj., Infraspinatus, Pectoralis minor and maj. (sternal)., Latissimus dorsi, Coracobrachialis, Triceps, Anconeus, Ext. carp. rad. long. et brev., Pronat. teres, Extensor comm. dig., Ext. carp. ulnaris, Ext. long. poll., Ext. metac. pollicis, Flex. carp. rad., Flex. carp. ulnar., Ext. min., dig. (slight), Flex. prop. digit., Flex. sublim. digit. (slight), Superficial short thumb muscles, Extensor indicis *and Teres minor, and Palmaris longus, in Macacus*	*Retraction and strong adduction at shoulder with some inward rotation of arm; arm is carried across the body; extention at elbow; slight flexion at wrist, with some pronation; slight flexion of fingers; shoulder is drawn down; slight retraction and lateral flexion of neck.*	ditto	ditto

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
C VIII.	*The radial side of the lower two-thirds of forearm; the whole of the hand and wrist, both back and front, and a small piece of the ulnar side of the forearm just above wrist. Destruction of this root—large as it is — produces no anæsthesia anywhere.*	Same as motor. Triceps tap.	Same as motor.	*Adduction and flexion of thumb; flexion of other digits; flexion or often extension at wrist; drawing inwards and downward of shoulder; retraction of upper arm; at elbow sometimes extension, sometimes flexion.*	Ranges between top of fifth and top of seventh spin. proc.
DI	*The ulnar side of the hand, including three fingers of that side; the ulnar side of the forearm, including the skin over the olecranon. Destruction of this root causes a patch of analgesia on ulnar side of flexor aspect of forearm.*	Same as motor. Triceps tap.	Same as motor.	*Movement at shoulder, sometimes retraction; contraction of triceps in part; flexion of digits with adduction of thumb; extension at elbow; sometimes flexion; some flexion and pronation at wrist.*	Ranges between above sixth and below seventh spin proc.
D II.	*The inner and posterior aspect of the upper arm and the inner aspect of the highest quarter of the forearm, including the inner condyle and the brachial wall of the axillary space.*	Same as motor.	Heart (ventricle) and lungs.	*Movement at shoulder; slight flexion of thumb and digits; sometimes contraction in triceps; sometimes dilation of homonymous pupil.*	Ranges from lower edge of sixth cerv. spine to that of first dors.
D III.	*Zone passing from sternum to back, sweeping round close above nipple and bounded by axial lines of limb above. Sweeps down axillary aspect of upper arm halfway to elbow.* Over middle of scapula and over third rib inside mammillary line (Head).	Same as motor.	Heart (ventricle) and lungs.	*Retraction of shoulders; contrac. of part of triceps.*	Ranges from upper edge of seventh cerv. spine to lower edge of second dorsal.
D IV.	*Zone of skin passing round chest, including axilla (lower part) and nipple. Reaches axial lines only near mid-dorsal and mid-venter.* Width of band is from third intercost. space down to sixth rib (Mertens).	Same as motor.	Heart (ventricle) and lungs.	*Retraction of shoulder; occasionally contraction of triceps.*	Ranges from top edge of first dors. spine to that of third.
D V.	*Zone behind lies just over angle of scapula; its upper edge rises to include nipple.* Head finds this the field to which nipple really belongs in man. Width extends from fourth rib to top edge of seventh (Mertens).	Same as motor.	Heart and lungs.	*Muscles of back and side of chest; the intercostal spaces involved are chiefly fifth and sixth; occasional retrac. of shoulder.*	Ranges from top edge of second to top of fourth doral spine.

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
Longus colli, Erector spinæ, Transversospinales, Serratus magnus, Scaleni, Pectoralis minor and maj. (sternal part), Latissim. dorsi, Triceps, Anconcus, Extensor carpi ulnaris, Flexor carpi radialis, Flex. carpi ulnar., Extensor indicis, Exten. communis digit., Ext. long. pollicis, Ext. metac. pollicis, Ext. miu digit., Palmaris long., Flex. long. pollicis, Flex. prof. digit., Flex. sublim. digit., Superficial and deep short muscles of thumb and little finger, the three most radial lumbricales and palmar interossei and all the dorsal interossei, Pronator quadratus.	*Shoulder drawn down; some adduction of shoulder; rotation inward of arm; flexion and pronation at wrist; flexion of fingers and of thumb with opposition.*	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.	Through connection with sympathetic supplies viscera as shown in chapter on Innervation.
Erector spinæ, Levator costæ, Transversospinales, Serratus postic. sup., Intercost., Scaleni, Pector. ma. et min., Triceps, Latiss. dorsi, Flex. carpi ulnar., Pronator quadratus, Flexor long. poll., Flex. prof. et sublim. digitor., Palmaris long., Ext. minimi digit, Lumbricales and interossei, Short muscles of thumb and of little finger, *Extensor carpi ulnaris in Macacus.*	*Retraction of shoulder; slight lateral flexion and retraction of neck; slight extension at elbow; flexion at wrist with pronation; slight abduction of wrist at ulnar side; flexion of fingers and thumb with opposition of latter.*	*Slight to vessels of head on same side.*	Dilation of pupil with widening of palpebral opening.
Erector spinæ, Levator costæ, Transversospinales, Serratus postic. sup. Scaleni, Intercostales. *Flexor long. pollic., Flex. sublim. et prof. digit., deep short muscles of thumb, short muscles of little finger; Interossei and lumbricales; in Macacus.*	*Retraction of shoulder; slight flexion of wrist; flexion of fingers and thumb with opposition of latter; lateral curving of the spinal column.*	*Blood-vessels of face and head on same side (tongue, ear, gums, thyroid, etc.); acceleration of heart.*	*Dilation of pupil; opening palpebral fiss.; secretion of submaxill. gland.*
Erector spinæ, Levator costæ, Transversospinales, Intercostales, Serratus posticus superior, Triangularis sterni.	ditto	*As for D II., and vasomotor to lungs. ? Vasom. to hand.*	*Slight dilat. of pupil; opening of palp. fiss.; secret. from Wharton's duct.*
Same as D III.	ditto	*As for D III., but slighter effect, except to lungs, where stronger, vasomotor to hand.*	*Slight opening palp. fiss.; secret. Wharton's duct; sweat glands of arm and hand.*
Erector Spinæ, Levator costæ, Transversospinales, Intercostales, Triangularis sterni, Obliq. extern. abd., Rect. abdom.	ditto	*Slight to vessels of head and face; and forearm and hand (strong), lung; slight acceleration of heart; slight constriction of portal vein.*	*Submaxill. secretion (slight); sweat glands of hand; contract. of spleen.*

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
D VI.	Lower border of zone runs from eighth dorsal spine to end in front below the attachment of the xiphoid cart (Head).	Same as motor.	Heart, lungs, stomach (cardiac end), *bile duct and gall bladder.*	*Muscles of back and side of chest; the intercostal spaces involved are chiefly fifth and sixth; occasional retrac. of shoulder.*	Ranges from lower edge of second dors. spine to upper of fifth.
D VII.	Lower border of zone at ninth dors. spine passes to end at junction of upper with middle third of space between xiphoid and umbilicus (Head).	Same as motor.	Heart (auricle), lungs, stomach (card. end), liver and gall bladder.	*Muscles of back and side of chest; some of the more superficial respond more readily than do those of the intercost. space. Those of the seventh, eighth, and sixth spaces do respond.*	Ranges from top of fourth to bottom of fifth dorsal spine.
D VIII.	Lower border of zone at eleventh dors. spine to end in front at junction of middle with lowest third of space between xiphoid and umbilicus (Head).	Same as motor.	Heart (auricle), lungs, stomach, liver, and gall bladder.	ditto	Ranges from top to fifth to top of sixth spinous p.
D IX.	Lower border of zone at twelfth dors. spine to end in front at the umbilicus (Head). According to Head the umbilicus lies between ninth and tenth dorsal fields.	Same as motor.	Stomach (pyloric), liver, gall bladder and intestine.	*Epigastric reflex* (Dinkler).	Ranges from midway between fifth and sixth dorsal spines down to top of seventh.
D X.	Lower border of zone at third lumbar spine to end in front midway down between umbilicus and symphysis (Head).	Same as motor.	Liver, gall bladder, intestine, prostate, testis, ovary, kidney, and top of ureter.	*Dilatation of renal vessels characteristic (Bradford).*	Ranges from lower edge of sixth to upper of eighth dors. spine.
D XI.	Lower edge of zone at fifth lumbar spine to end in front at junction of middle and lower thirds of space between symphysis and umbilicus (Head). The groin just above Pourpart's lig. lies in this field.	Same as motor.	Intestine, kidney, ureter, prostate, epididymis, and uterus (not os), ovarian appendages.	*Muscles of flank abdomen and intercostal space; renal dilatation characteristic. With moderate stim. no movement of limbs.*	Ranges from top of seventh dors. spine to top of eighth.
D XII.	Lower edge of zone crosses below crista ilii and on the outer side of thigh below Pourpart's ligament; this border gives a characteristic short tongue-shaped flap on front of thigh. *The first lumbar field of Macacus corresponds with Man's D XII.*	Same as motor.	Intestine, kidney, ureter, epididymis, uterus (not os), urinary bladder ovarian appendages.	*Muscles of flank contract; retraction of abdominal wall low down; flexion at hip; renal dilatation characteristic.*	Ranges between top of eighth dors. spine and bottom of ninth.

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
Same as D V.	*Retraction of shoulder; slight flexion of wrist; flexion of fingers and thumb with opposition of latter; lateral curving of the spinal column.*	*Constriction in forearm and hand, lung, portal system, pancreas and intestine; slightly in kidney.*	*Secretion in sweat glands of hand; contraction of spleen.*
Erector spinæ, Levator costæ, Transversospinal, Subcostalis, Intercostales, Obliq. ext. abd. et int. abd., Rectus abd. and Transvers. ab.	ditto	*Of lung slightly, of hand, portal system, liver, pancreas and intestine strongly, of kidney distinctly.*	*Sweating of hand; movement of spleen and intestine.*
Same as D VII.	ditto	*Of forearm and hand, portal system kidney, liver, pancreas and intestine.*	*Sweating of hand; movements in spleen and intestine.*
Erect. spin., Lev. cost., Transv. spin., Subcostales, Intercost., Obliq. ext. et int. abd., Transversus abd., Rect. abd., Serrat. post. inf.	ditto	*Of forearm and hand (slight), of portal venous system, liver, pancreas, intestine, and kidneys.*	*Sweating of hand; movements in spleen and intestine.*
Same as D IX.	ditto	*Of kidney, liver, pancreas and intestines.*	*Movements in spleen and intestine.*
Same as D IX.	ditto	*Of liver, pancreas and intestine; construction in leg and foot (slight).*	*Movements in intestine; sweating of foot (slight).*
Erect. spin., Lev. cost., Transv. spin., Subcostalis, Intercostales, Obliq. ext. et int. abd., Transvers. abd., Rect. abd., Pyramidalis (Quadratus lumborum).	*Retraction of abdominal wall; no movement of limb.*	*Of liver, pancreas, intestine, leg and foot.*	*Movement of intestine; sweat glands of foot.*

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
L I.	*Second lumb. of Macacus (=Man's L I.). Lower edge of zone sweeps from sacrum across buttock about midway between gluteal fold and crista ilii, comes more than one-third down front of thigh and recurves to symphysis.*	Same as motor.	Bladder, prostate, epididymis, and uterus.	*Retraction of abd. wall; slight flexion at hip, retraction of testis; cremasteric reflex.*	Ranges between top of ninth dors. spine and bottom of tenth.
L II.	*L III. of Macacus (=L II. of Man). Lower edge sweeps from dorsal axial line of limb over outer side of thigh and passes across close above or on patella to return along the adductors and ventral axial line to symphysis.*	Same as motor.	None known.	*Curving of body toward side stimulated; flexion at hip, rarely at knee; retraction of testis; cremasteric reflex.*	Ranges between ninth and eleventh dors. spines.
L III.	*L IV. Macacus (= L III. Man). From the dorsal axial line of limb sweeps over ilium down extensior face of thigh, over knee and inner face of highest half of leg to the ventral axial line of the limb at the inner edge of thigh,* i. e., *skin covering* gracilis *and inner line of attachment of calf muscles.*	Knee-jerk. Same as motor.	None known.	*Curving of body toward side stimulated; flexion at hip, and at knee; flexion of hallux occasionally; adduction at hip; rarely slight dorso-flexion at ankle.*	Ranges between top of tenth and bottom of eleventh dors. spine.
L IV.	*L V. Macacus (=L I V. Man). Field a rough isosceles triangle with apex at hallux, and base on front of and halfway up thigh, exhibiting a deep downward notch in it.*	Knee-jerk. Same as motor.	None known.	*Flexion at hip, at knee, and of toes, often slight dorso-flexion at ankle; adduction at hip often as a crossed effect; glutæl reflex.*	Ranges between bottom of tenth and top of twelfth dors. spine.
L V.	*Field includes whole of foot and ankle, but while barely comprising the intern. malleolus, sweeps up the peroneal side of the leg to reach the outer hamstring at the knee. Area resembles a sock with oblique upper edge.*	Same as motor.	Prostate.	*Flexion at knee; flex. of hip with some internal rotation; flexion of hallux and other digits; dorso-flex. of ankle with tilting outward of foot; crossed adduction of thigh; glutæl reflex; plantar reflex.*	Ranges between top of eleventh dors. spine and top of twelfth.

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
Erect. spin., Lev. cost., Transv. spin., Quadratus lumborum, Obliq. abd. internus, Transv. abdom., Pyramidalis, Cremaster (Psoas maj., Psoas min.).	*Retraction of abdominal wall; slight flexion at hip.*	*Liver pancreas, intestine, leg and foot.*	*Movement of intestine and bladder; intern. sphinc. ani contracts; sweat glands of foot; was deferns and vessemin; uterus.*
Erector spin., Lev. cost., Transv. spin., Quad. lumb., Psoas ma. et mi., Iliacus, Pectineus, Gracilis, Sartorius (upper part only), Add. long. et brev., Cremaster *Data largely experimental.*	*Retraction of lower part of abdom. wall and testis; flexion at hip.*	*Of leg and foot.*	*Movement of bladder and intestine; int. sphinc. ani contracts; sweat glands of foot; uterus; contract. of round ligament; vas deferens; vesic. seminalis.*
Erector spin., Multifid. spin., Psoas ma. et mi., Iliacus, Pectineus, Obturator ext., Add. magnus, brevis, longus, Sartorious (esp. lower part). Vastus medialis, Rectus femoris, Vast. lateralis, Crureus, Gracilis. *Data largely experimental.*	*Retraction of part of abdom. wall; flexion and adduction at hip; extention at knee.*	*None*	*None*
Erector spin., Multifid. spin., Rectus fem., Vastus med. et lat., Crureus, Gracilis, Obturat. ext., Adduct, magn. et brevis, Quad. femoris, Tensor fasciæ femoris, Tibialis anticus, Ext. long. digitorum, Ext. proprius hallucis, Semimembranosus (slight), Glutæus med. et min. *Data largely experimental.*	*Adduction at hip; extention at knee; some dorso-flexion at ankle, and some extension of hallux.*	*None*	*None*
Erector spin., Multifid. spin., Tibial. ant., Ext. long. dig., Ext. hall., Glutæus max. med. et min., Peroneus long., Exten. brev. dig., Gast. (outer head more than medial), Tibialis post., Flex. long. digitor., Flex. long. hallucis, Semimembranosus, Adduct. magnus (condylar	*Extension at hip; adduction of thigh; weak flexion at knee; dorso-flexion at ankles; extension of toes; adduction of hallux.*	*None*	*None*

AFFERENT ROOT

No. of Nerve	Skin	Muscle	Viscera	Reflex Movement	Level of Surface Origin
S I.	*A long field including the four outer digits, the outer two-thirds of the sole, the posterior aspect of the ankle, the calf and the lower three-fourths of the back of the thigh.*	Foot clonus. (Ziehen).	Prostate.	*Flexion at knee; flexion at hallux and digits; dorso-flexion of ankle; very rarely plantar flexion; plantar reflex.*	Ranges between lower border of eleventh dors. spine and top of first lumb.
S II.	*Back of thigh from behind the knee (sometimes upper part of calf) up to the ischial tuberosity and fold of the buttock.*	Foot clonus. Same as motor.	Prostate, bladder, rectum, os uteri.	*Flexion of digits; slight flexion of knee; protrusion of anus.*	Usually between twelfth dors. and fiss lumbar spiner.
S III.	*Patch covering perineum and buttock and sweeping forward over under surface of scrotum and penis.*	Same as motor.	Prostate, bladder, rectum, os uteri.	*Protrusion of anus; flexion of hallux; anal reflex.*	ditto
S IV.	*Triangular patch, with apex laterally, lying on sacrum.*	Same as motor.	Prostate, bladder, rectum, os uteri.	*Protrusion of anus; anal reflex.*	ditto

EFFERENT ROOT

Striped Muscle	Chief Movement Effected	Blood-Vessels	Glands of Viscera
portion), Semitendinosus, Biceps (cap. long); Quadratus femoris, Gemell. sup. et inf., Plantaris, Popliteus, Abductor hallucis, Flex. brev. digitorum, Obtur. int. (Pyriformis, Abductor min. digiti, and Soleus, all very slightly innervated). *Data largely experimental.*			
Multifid. spin., Glutæi max. med. et min., Pyriformis (esp. lateral part), Biceps (caput breve and longe), Semimembranosus, Semitendinosus, Gemellus superior, Peroneus brevis, Peroneus longus (slightly), Extens. longus digitorum, Extens. brevis digitorum, Ext. breve. hallucis, Gastrocnemius, Popliteus, Plantaris, Flex. long. digit., Flex. long. hallucis, Soleus, Tibialis posticus, Flexor brevis digit., Abduct., hallucis, Abduct. min. digit., Flex. accessorius, Flex. brev. hall., Flex. brev. min. digit., Adduct. hallucis (Quadrat. fem. slightly), Ext. sphincter ani, Sphincter vaginæ, Lumbricales and interossei, Obturator internus. *Data largely experimental.*	*Flexion at knee; extention usually* (i.e. *plantar flexion*) *at ankle; inversion of sole; strong flexion; adduction of hallux; movement of anus.*	*None known accurately.*	*Protrusion and erection of penis; slight cont. of bladder.*
Multifidus spin., Glutæus max., Biceps (both heads), Semitendinosus, Semimembranosus, Gastrocnemius, Soleus, Abductor hallucis, Flex. brev. digit., Flex. accessor., Abductor minim. digiti, Adductor hallucis, Obturator internus, Pyriformis (small medial part), Flex. brev. hallucis, Flex. brev. min. digit., Lumbricales and Interossei, Ext. sphincter ani, and Sphincter vaginæ. *Data largely experimental.*	*Flexion at knee; extension at ankle; flexion of toes; movement of anus.*	*Dilator to genitalia and lower rectal muc. memb.*	*Contraction of bladder; protrusion and erection of penis with turgor; descending colon and rectum; int. sphinct. ani relaxes.*
Multifidus spinæ, etc., Levator ani, Sphincter ani (in some individuals), Perineal muscles.	*Perineal*	*Dilator to genitalia and lower rectal muc. memb.*	*Contraction of bladder; turgor of penis; descending colon and rectum; int. sphinct. ani relaxes.*
Levator ani, Perineal muscles.	*Perineal*		

The following table shows the relation of the vertebral spinous process to the segments of the spine.

Cervical Segments	Spinous Processes
1st, 2nd	Posterior tubercle of atlas.
3rd, 4th	Spinous process of axis.
5th	Spinous process of 3rd cervical.
6th	Spinous process of 4th cervical.
7th, 8th	Spinous process of 5th cervical.
Thoracic Segments	
1st, 2nd	Spinous process of 6th cervical.
3rd	Spinous process of 7th cervical.
4th	Spinous process of 1st thoracic.
5th	Spinous process of 2nd thoracic.
6th	Spinous process of 3rd thoracic.
7th	Spinous process of 4th thoracic.
8th	Spinous process of 5th thoracic.
9th	Spinous process of 5th thoracic.
10th	Spinous process of 6th thoracic.
11th	Spinous process of 7th thoracic.
12th	Spinous process of 8th thoracic.
Lumbar Segments	
1st	Spinous process of 9th thoracic.
2nd, 3rd	Spinous process of 10th thoracic.
4th, 5th	Spinous process of 11th thoracic.
Sacral Segments	
1st, 2nd, 3rd, 4th, 5th	Spinous process of 12th thoracic.
Coccygeal Segment	
1	Spinous process of 1st lumbar.

CHAPTER II

Spinal Symptomatology

Having considered the normal spinal column, we will now direct our attention to a study of those changes which occur in the spine and its ligaments, the anatomical structures connected with it, and various subjective symptoms resulting from subluxations of the vertebrae. These various signs and symptoms referable to the spine and the parts governed by the nerves of the different segments of the spine point to vertebral subluxations in various segments, and are of great assistance in making a correct spinal analysis.

As stated in a previous section of this work, proper attention has been given by the medical profession to symptoms indicating gross spinal deformities, such as Pott's disease, scoliosis from occupation, habits, or injury, and lordosis, but those symptoms referring to the possible existence of displacements involving a single vertebra instead of a group, have been left uninvestigated. In many cases these symptoms point so clearly to the evident existence of an interference with the nerve-supply of a part that it is surprising that the seat of this interference should for so long a time have remained unsought for and unfound.

To practitioners of spinal adjustment a general knowledge of the symptoms pointing to a vertebral subluxation are very important; first, they give an accurate knowledge of the existence of a lesion and its location; second, without such a knowledge proper correction of the diseases produced by the lesion through adjustment of the lesion is impossible.

The symptoms and signs which indicate the existence of a vertebral subluxation are the following:

1. Mal-alignment of the vertebrae.
2. Contraction of the spinal muscles and ligaments.
3. Diminished mobility of the back.
4. Pain.
5. Tenderness.

6. Symptoms referable to certain organs, systems, or parts of the body.
7. Local zone of increased temperature.
8. Thickening of the nerve trunks.
9. Changes in anatomical structures connected with the spine.

Mal-alignment of the Vertebrae as a Sign of Vertebral Subluxations.—By mal-alignment of vertebrae is meant especially that of the spinous processes, as found by examination. Normally the spinous processes should be either seen or felt to be in perfect alignment, with no deviation upward, downward, anteriorly, posteriorly, or to either side. When the end of a certain spinous process is found to be out of line with the one above and below it, it usually indicates the presence of a corresponding deviation from its normal position of the vertebra of which it is a part. This is, however, not invariably true, since the spinous process may project from the vertebra of which it is a part at different angles from the normal. For this reason it becomes necessary, for purposes of verifying the findings and conclusions from inspection and palpation of the spinous processes to carefully palpate the transverse processes. If for example, a certain spinous process projects backward beyond the one above and below it, it may indicate that the entire vertebra is displaced posteriorly; but it may also be merely an abnormally long spinous process resulting from over-development, as is frequently seen in osteological collections. If, however, it is found that the transverse processes are also displaced backward beyond those of the vertebra above and below, it may then be concluded that the vertebra in question is really displaced posteriorly.

To determine mal-alignment of vertebrae palpation of both the spinous and transverse processes is absolutely essential in every instance. The subject of the detection of mal-alignment of vertebrae will be considered at full length in the chapter on spinal examinations. This is the foremost symptom of vertebral subluxations, and the one which will receive the greatest attention. The finding of mal-alignment of a certain vertebra makes it conclusive that a subluxation

exists in that segment of the spine, without any further examination being necessary, and all other symptoms and signs are of subsidiary importance. They are, however, of sufficient importance to demand a careful study, since they very often give the first evidence that a subluxation is present, when mal-alignment is not evident on inspection, and the spine has not been palpated.

Contraction of the Spinal Muscles and Ligaments.—At those points where a subluxation exists there will always be found a contracted condition of the corresponding ligaments and muscles. This condition is sometimes so marked that it can be seen on inspection of the spine, but is usually very readily determined by palpation. When the first three fingers of each hand are passed down the spine, along the sides of the spinous processes, there will be noticed at certain points a thickening of the muscles and ligaments. This contraction, as shown in the chapter on reflex subluxations, is more evident on one side of the involved segment, for the reason that the nerve-impulses which cause the tetanic contraction of the muscles were stronger on one side, namely, that on which the efferent impulse following irritation of the nerve-endings at the periphery entered the spinal cord.

It can be considered as certain that where such contractures are found there will be a displacement of the corresponding vertebra, since the constant contraction of the ligaments on one side destroys the balance that should exist on both sides, and the vertebra will be drawn toward the side which is contracted.

These contractures are present in both acute and chronic subluxations, but the hard and indurated condition of the muscles and ligaments in the latter case serves to distinguish it from the former.

The contracted condition of the muscles may not only be the cause of a reflex subluxation, but is also present in those displacements produced by other causes, as enumerated in the chapter dealing with the production of vertebral malalignment. Muscular rigidity is the earliest sign in nearly every abnormal condition in any part of the body, and it is the observance of such rigidity which first calls attention to the presence of an abnormal condition. All abnormal condi-

tions produce an excessive irritation at the periphery, resulting in increased reaction of the motor nerves which produces the muscular rigidity. Thus muscular rigidity is one of the earliest signs of Pott's disease, and persists until the condition is cured. It is most pronounced in the immediate region of the affected portion of the spine, although it also extends to some distance in either direction along the back. The muscular rigidity accompanying disease in any joint is a common observance, and illustrates this point.

If, therefore, muscular rigidity is a constant concomitant of all joint lesions, it follows that it must also occur when individual vertebrae are affected. Further, if its presence in any region of the body points undeniably to an abnormal condition of that part of the body, its detection in certain segments of the vertebral column also indicates an abnormality there. Whenever there is noted the presence of muscular rigidity about any joint in the body, it is at once concluded by the observer that a lesion of that joint is present. It follows therefore, that when muscular rigidity of the muscles and ligaments about a certain segment of the spine is noted that a lesion of the corresponding vertebral articulation must be present.

Diminished Mobility of the Back.—This is a very important sign of vertebral subluxations, and is of itself sufficient evidence that a displacement must exist. Diminished mobility of any portion of the body is evidence of the existence of some disease process in that region. Thus upon the slightest involvement of one of the joints of the extremities, there follows muscular rigidity and pain, both of which factors operate in the production of diminished mobility of the part involved.

If, therefore, diminished mobility is an indication of disease in other parts of the body, it must be considered in the same light when it is present in a certain segment of the spine. When, for example, the nodding of the head cannot be executed freely and painlessly, it indicates an implication of the occipito-atlantal articulation. If the face cannot be turned easily from one side to the other, an abnormality of the atlanto-axial articulation is present. If flexion of the head cannot be performed freely and painlessly, it shows

that there is present a subluxation in the lower cervical region. To determine the degree of motility of the dorsal region of the spine the subject should be instructed to bend forward, with the knees held stiff, until the trunk is horizontal, with the hands hanging down. The operator then views the spine with his head on a level therewith, and notes whether either side of the trunk is more prominent, either generally or locally in certain segments of the column. The patient is next instructed to bend backward as far as possible, and any local contractures indicating diminished movement in that part of the spinal column are carefully noted. Lastly, the subject is instructed to bend toward either side and any local or general lack of motility is looked for.

If, when the patient is bending forward, there is restricted movement or lack of flexibility, it is an indication that there is a settled condition of the vertebral column or that the muscles and ligaments thereof are contracted. If, instead of bending straight forward, the spine curves toward either side, when the patient bends forward, it indicates a contracted condition of the ligaments and muscles on one side.

Lack of mobility of any portion of the spinal column indicates contraction of the ligaments and muscles of the corresponding spinal segment. This will of necessity produce a deviation of the vertebra toward the contracted side and result in pressure upon the structure by the displaced margins of the intervertebral foramen through which they pass.

Pain.—This symptom is always a very important sign of a positive lesion in some part of the body. Usually pain exists at the location of the lesion which produces it. Frequently, however, there is no pain at the seat of the lesion but the sensation is referred to distant points. Ordinarily when a subluxation of sufficient severity to cause marked pressure to be brought to bear upon a nerve is present, there will be pain felt at the point impinged. More often, however, the patient has no subjective sensation of pain, but tenderness may be elicited by pressure over the affected area.

This has long been a mooted question. The question constantly arises: Why, if a nerve is pressed upon, is there no pain at the point of pressure? This is so for the reason that

in most instances pain is not perceived by the subject at its seat of production, but is referred to the peripheral distribution of the nerve. Thus when pressure upon a nerve occurs at the point of its emergence from the intervertebral foramen no pain may occur at that point but is perceived at the peripheral distribution of the nerve.

The perception of pain at the knee in cases of hip disease is the most common example of referred pain. Very often in such cases the patient does not experience the slightest pain at the seat of the lesion in the hip, and disease of that joint is, therefore, frequently overlooked. It is for this very reason that no pain being present at the seat of a subluxation its occurrance is not thought of. Whenever, therefore, pain is complained of by a patient in a certain region of the body, the operator should always look carefully for a subluxation in that spinal segment from which the nerves which supply such a painful area are derived; in most instances a subluxation will be found there.

For example, a patient may complain of pain in the eyeball; we know that the upper cervical and also the upper dorsal segments communicate with nerves to the eye, and by careful palpation of the vertebrae in these regions of the spine a subluxation will generally be found.

Pain thus becomes a very important assistant in the making of a correct spinal analysis, not alone when situated at the point of the producing lesion, namely the impingement, but also when referred to a point at some distance from this.

Tenderness.—This symptom is a very positive indication of the existence of a subluxation in the area in which it is elicited by pressure upon the nerve. Its importance as a symptom of a subluxation is that immediately after correction of the displacement of the vertebra the tenderness disappears. Pain and tenderness must not be considered synonymous, since, although tenderness on pressure is usually manifested over the seat of pain, this is not always true, as either pain or tenderness may exist separately. Pain is a subjective symptom felt more or less constantly, while tenderness is perceived by the patient only when pressure is made on the affected part.

Symptoms Referable to Certain Systems, Organs, or Parts of the Body.—As has been previously stated, perfect function of all parts of the body is dependent principally upon proper innervation. When, therefore, the nerve-supply to any part is interfered with by inability of the nerves to conduct impulses to it, improper function, with its attendant symptoms will ensue. By a knowledge of the innervation of every part of the body symptoms referable to that part may very readily be referred to the spinal segment which controls it, and in most instances a subluxation will be found at that point.

Thus, if a patient complains of symptoms referable to a gastric disturbance, careful palpation of the fifth, sixth, and seventh thoracic vertebrae will invariably demonstrate the existence of a displacement of one of these vertebrae. If together with this some of the other previously enumerated signs of vertebral subluxation are found to be present, it cannot be denied that a displacement is present, and that it has a marked bearing on the disease.

In the section on Practice the symptoms of disturbances of the various organs are given, and by referring these to the proper organ, and then recalling its innervation, and finding the vertebrae subluxated which result in impingement of these nerves, we see what an important sign of subluxations such symptoms are.

If disturbed function is present, we know that it is due to disturbed innervation of the involved part; we know further that the only logical place where interference with the conduction of nerve-impulses could occur is at the point where it passes between movable bones, namely through the intervertebral foramina. Vertebral subluxations must therefore be considered the primary factor in the production of disturbed function, not discountenancing the secondary or contributing factors.

The wide range of disorders which may be produced can readily be appreciated by recalling the efferent functions of nerves, namely, trophic, motor, secretory, and inhibitory or augmentory.

The first of these functions of the nerves is their influence on nutrition. This in its broadest sense includes di-

gestion, respiration, absorption, and metabolism. The great number of disorders which result from improper digestion, respiration, absorption and metabolism thus all depend for their production largely upon vertebral mal-alignment.

The second of the functions of the nerves, namely their influence on motion, is exceedingly important, for upon their motor impulses depend the proper functioning of nearly all parts of the body—the contraction of the heart, the movements of respiration, the movements of the stomach and intestines, the secretions of the glands, and so on. A little thought will at once bring to mind many diseases known to result from disturbance of these functional activities, and it is unnecessary to enumerate them here.

The third function of the nerves, namely secretory, is also important, since a great number of diseases can be traced to disordered secretion. This is apparent when it is recalled how many parts of the body are engaged in this function: Namely, all serous and synovial membranes, the mucous membranes with their special glands, as the buccal, gastric and intestinal glands, the salivary glands, the pancreas, mammary glands, liver, lachrymal glands, the skin, the kidneys, the testes, the ovaries, the thyroid gland, the adrenals, the pituitary body, and the spleen.

As examples of the last of the functions of nerves, namely their influence on existing action, may be cited the inhibitory action of the vagus nerve upon the heart.

All these functions of the nerves merge more or less closely into each other, and a vertebral subluxation which affects the power of conduction of a certain nerve will, therefor, affect all the functions of the parts which that nerve controls. Disturbances of functions in various parts of the body as shown by the symptoms produced thus are an important sign of mal-alignment of vertebrae. They point to the necessity for the occurrence of a subluxation, and also to its location. Anyone who cares to do so, may demonstrate this for himself, on any clinical case.

Local Zone of Increased Temperature.—By recalling the functions of nerves we find that they control the temperature of all portions of the body. The temperature of the skin varies from hour to hour according to the activity of the

cutaneous circulation. The vasomotor nerves of the sympathetic system control the circulation, and when their function is in abeyance, vasodilation with increased surface temperature results. Thus when a spinal nerve is compressed by the margins of the intervertebral foramen of a subluxated vertebra, the skin of the corresponding segment of the back is found to be warmer. Conversely, whenever a certain segment of the back is found to be warmer than the adjacent segments, a subluxation will always be found at that point.

Thickening of the Nerve Trunks.—In palpating the vertebral column along the laminae the nerves will sometimes be felt to be thickened. This is due to a thickened condition of the sheath of the nerve, as a result of congestion of the spinal segment from which the nerve emanates.

At all points where this thickened condition of the nerves is found a subluxation will always be located, and this then becomes another important sign of vertebral mal-alignment.

Changes in the Anatomical Structures Connected with the Spine.—Subluxations of the vertebrae may be determined by comparing the height and prominence of the scapulae, the prominence of the angles of the ribs, and the prominence of the iliac crests. If any variation on the two sides of the body is noted, it indicates that a subluxation is present, and is an important symptom, and valuable aid in spinal analysis. The various methods for eliciting these various differences from the normal will be discussed in detail in the chapter dealing with the examination of the vertebral column.

CHAPTER III

Spinal Diagnosis

Spinal diagnosis is the determination of disease in a certain system, organ, or part of the body by the detection of a vertebral subluxation which interferes with the conductivity of the nerves supplying that part.

Ability to make a correct diagnosis from the palpation of a vertebral subluxation depends upon a thorough knowledge of the nervous system, the nerve-supply to the different parts of the body, and the function of the nerves emanating from each spinal segment.

A ready familiarity with the pathological changes which may occur in every organ is also very essential, in order that the condition of the part which is improperly innervated may be known.

It is impossible from the spinal analysis alone to make a diagnosis of the nature of the disease. What the spinal analysis determines is that disease of a certain organ exists; the special examination of the organ then establishes the exact nature of the disease. For example, detection of a subluxation at the fourth thoracic segment determines the fact that there is disease of the liver, but whether the disease is cancer or congestion it is impossible to state; only the special examination of the liver and the general symptom complex can determine this.

A thorough understanding of the above principle makes the diagnosis of disease in certain parts of the body extremely accurate, and the palpation of the vertebral column for the detection of subluxations is one of the most valuable aids in the making of a correct diagnosis that we have at our command. For example, diagnosis of conditions in the abdomen is often very difficult; this is true for the reason that we are dealing with a number of organs, all adjacent to each other and the condition of which is constantly changing. Thus the stomach at one time contains solids, at another liquids, at another time gas; a tumor in the abdomen

may be connected with the liver, the kidney on the right side, the stomach, the ovary, it may be an enlarged mesenteric gland, an enlarged spleen, a cyst of the omentum, or simply a mass of fecal matter. There is no necessity for calling attention to the fact of the differing diagnoses of different physicians in regard to abdominal conditions, and how often wrong diagnoses are made; often, alas, to the patient's detriment. There differences in diagnosis are very often not alone in respect to the nature of the disease with which a certain organ is affected, but frequently differences of opinion exist as to what organ is affected. This is not surprising when we consider that the abdominal organs are loosely packed in the abdomen, and reliance must be placed entirely on palpation and percussion in the physical examination of the parts.

An enlarged liver may be confused with an enlargement of the right kidney, an enlarged spleen, a tumor of the pyloric end of the stomach, or impaction of the hepatic flexure of the colon. By palpation of the mass it is frequently impossible to state with which of these organs the tumor is connected. Often percussion does not give any assistance, since the dullness elicited by percussion is so similar over all the organs that the slight shade of difference cannot be distinguished. By palpation of the vertebral column, and the detection of a subluxation in a certain segment, however, the exact organ affected can be readily determined.

Let us carry the above illustration farther, and suppose that a tumor mass is palpated in the abdomen, but by all the usual methods of examination it has been impossible to determine which of the organs is affected. If the spine is then palpated, the following findings will establish which of the organs is affected. If the fourth thoracic vertebra is subluxated, the tumor is in connection with the liver; if the fifth, sixth, or seventh thoracic vertebra is subluxated, it is connected with the stomach; if the eighth thoracic vertebra is the one subluxated, it may be concluded that the spleen is involved; if the tenth thoracic vertebra is subluxated, the kidney is the organ affected; if the lower thoracic or upper lumbar vertebrae are the seat of subluxations, the trouble is located in the intestines. These findings are constant, that

is to say, if the disease is of the liver, a subluxation will invariably be found at the fourth thoracic vertebra, and similarly of the other viscera as outlined above. By such a process we are able to determine exactly which organ is affected in conditions affecting the abdominal viscera.

There is one difficulty in the making of a diagnosis by spinal analysis. This is the fact that in a few instances the same nerve supplies different organs, and if this nerve alone were impinged it would naturally be impossible to state which of these organs is affected, and a consideration of the symptoms and signs would be necessary. However, no disease process exists long in any organ before reflex subluxations are produced in those segments from which the organ in question derives its innervation as explained fully in the chapter on reflex production of mal-alignments of vertebra. From these secondary subluxations it then becomes possible to determine the organ which is involved. After the specific organ involved has been decided upon, the special examination of the organ and the careful consideration of all symptoms and signs present, together with chemical and microscopical analysis of urine, feces, blood, gastric contents, sputum, and other methods of diagnosis should be used.

In the past many practitioners of spinal adjustment have made the claim that they were able from the analysis of the spine to make an absolute diagnosis of the patient's disease. Some were honest in this claim, but simply ignorant of the fact that it is one thing to know what organ is affected, and another how that organ is affected. These persons had no knowledge of pathology. They simply considered it sufficient to know what organ is affected, and it possibly never occurred to them to ascertain how that organ was affected. Many who may have thought of this feature paid no further attention to the subject, but were content with using spinal adjustment and considered it sufficient to know that the patient was cured. This is an extremely unscientific manner of treating disease, however, and leads to many gross errors. As a matter of fact, the patient is usually himself aware before he consults a physician what organ is diseased, and wishes to know how that organ is affected. For example, a patient complains of a group of symptoms which point

directly to disease of the liver; he is however unable to interpret these symptoms correctly, and therefore unable to say what the nature of the disease is. It is his desire to know this that prompts him to consult a physician. Without an exact knowledge of the specific nature of the disease the operator is unable to give a correct prognosis. Here some may differ for the claim is still made by them that all diseases are curable by spinal adjustment, and that, therefore, prognosis is good in all cases. Facts will not bear out such claims, since there are still some diseases for which no remedy has been as yet discovered, and spinal adjustment will not cure cancer, for instance. From a specific diagnosis we are therefore enabled to state the exact nature of the disease and give an approximately accurate prognosis, as well as treat any of the diseased conditions which so often complicate disease of certain organs.

The following tables will assist the operator in making a diagnosis as to the organ, part, or system which is affected when vertebral subluxations are found in certain sections of the vertebral column:

The 1st Cervical Nerve.—Superior and inferior oblique, complexus, rectus capitis posticus major and minor muscles; skin of occiput; cranium, brain, face, ears, eyes, larynx; chills and fever.

The 2nd Cervical Nerve.—Complexus, obliquus inferior, semispinalis, multifidus spinae muscles; posterior half of scalp; larynx; fevers.

The 3rd Cervical Nerve.—Integument of the occiput and posterior cervical region; eyes, larynx, heart, lungs, diaphragm; fevers.

The 4th Cervical Nerve.—Scaleni, supraspinatus, infraspinatus, rhomboidei, teres minor muscles; throat, thyroid gland, eyes, diaphragm, heart; fevers; vasomotor nerves.

The 5th Cervical Nerve.—Subclavius, supraspinatus, infraspinatus, subscapularis, teres major and minor, deltoid, brachialis anticus, biceps, serratus magnus, pectoralis major and minor, flexor sublimis, digitorum, lumbricales muscles; eye, heart, thyroid gland, throat; fevers; smallpox.

The 6th Cervical Nerve.—Subclavius, supraspinatus, infraspinatus, subscapularis, teres major and minor, deltoid,

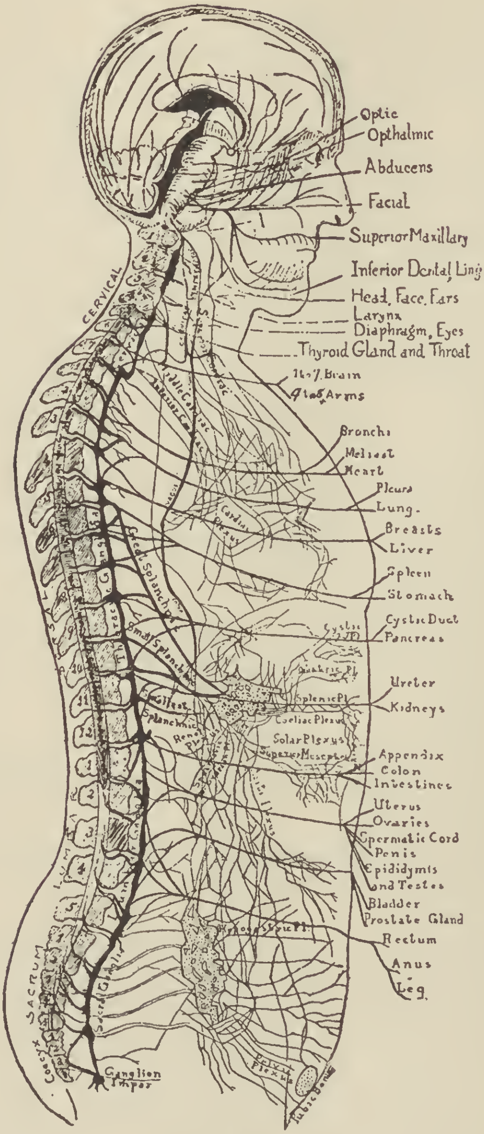

Fig. 41
Segmentation Chart.

brachialis anticus, biceps, pronator teres, pronator quadratus, latisimus dorsi pectoralis major and minor, serratus magnus, triceps, supinator longus and brevis, flexor carpi radialis, palmaris longus, extensor carpi radialis longior and brevior, abductor pollicis, opponens pollicis, flexor pollicis muscles; eyes, ears, throat, thyroid gland; chills aid fever.

The 7th Cervical Nerve.—Extensor carpi radialis longior and brevior, opponens pollicis, flexor pollicis, abductor pollicis, serratus magnus, coraco-brachialis, extensor communis digitorum, extensor pollicis longus and brevis, extensor carpi ulnaris, abductor indicis, abductor minimi digiti, extensor indicis, extensor minimi digiti, latissimus dorsi, triceps, anconeus, pectoralis major; brain.

The 8th Cervical Nerve.—Latissimus dorsi, triceps, anconeus, pectoralis major and minor, flexor carpi ulnaris, flexor profundus digitorum, flexor longus, pollicis, pronator quadratus, flexor sublimis digitorum, lumbicales, interossei, pleura abductor pollicis, flexor brevis pollicis muscles.

The 1st Thoracic Nerve.—Pronator quadratus, flexor carpi ulnaris, flexor longus pollicis, flexor profundus digitorum, intrinsic muscles of hand, pupillary fibres; eye, heart, pericardium, lungs, liver integument of the body.

The 2nd Thoracic Nerve.—Intercostal muscles; vasomotor nerves; disorders of the arm; heart; fevers; bronchi; mediastinum.

The 3rd Thoracic Nerve.—Intercostal muscles; heart, lungs and pleura; liver; eye; integument of body.

The 4th Thoracic Nerve.—Intercostal muscles; heart, lungs and pleura.

The 5th Thoracic Nerve.—Intercostal muscles; breasts, pleura, liver, constitutional diseases, stomach, spleen.

The 6th Thoracic Nerve.—Intercostal muscles; stomach, spleen.

The 7th Thoracic Nerve.—Intercostal and abdominal muscles; stomach, spleen, gall bladder.

The 8th Thoracic Nerve.—Intercostal and abdominal muscles; stomach, spleen, gall bladder, cystic duct, pancreas; chills and fever.

The 9th Thoracic Nerve.—Intercostal and abdominal

muscles gall bladder, spleen, pancreas, stomach, cystic duct; chills and fever.

The 10th Thoracic Nerve.—Intercostal and abdominal muscles; pancreas, spleen, cystic duct, diaphragm, kidneys and ureters.

The 11th Thoracic Nerve.—Abdominal muscles; diaphragm, pancreas, kidneys, bladder, intestines.

The 12th Thoracic Nerve.—Abdominal muscles; diaphragm, kidneys and ureters, large and small intestines, vermiform appendix, uterus, prostate gland, testes, ovaries, epididymis, spermatic cord, penis.

The 1st Lumbar Nerve.—Quadratus lumborum muscle; large and small intestines, vermiform appendix, uterus, ovaries, Fallopian tubes, testes, spermatic cord, epididymis, penis, bladder; muscles of the lower extremities.

The 2nd Lumbar Nerve.—Cremaster and muscles of lower extremity; intestines, vermiform appendix, uterus, ovaries, Fallopian tubes, testes, epididymis, penis, spermatic cord; fevers.

The 3rd Lumbar Nerve.—Gracilis, adductor longus and brevis, quadriceps fermois, obturator externus, uterus, ovaries, Fallopian tubes, prostate gland, spermatic cord, epididymis, testes, penis, bladder.

The 4th Lumbar Nerve.—Gracilis abductor longus and brevis, quadriceps femoris, obturator externus, gluteus medius and minimus, tensor fasciae femoris, semimembranosus, popliteus, plantaris, quadratus femoris, gemellus inferior, crureus muscles; rectum, anus.

The 5th Lumbar Nerve.—Adductor longus, gluteus maximus, medius and minimus, tensor fasciae femoris, semimembranosus, quadratus femoris, popliteus, plantaris, gemellus superior and inferior, flexor longus digitorum, tibialis posticus, flexor brevis digitorum, flexor brevis hallucis, abductor hallucis, biceps femoris, abturator internus, semitendinosus soleus, flexor longus hallucis muscles, bladder, prostate gland, rectum and anus.

The 1st Sacral Nerve.—Gluteus maximus, medius and minimus, semimembranosus, semitendinosus, quadratus femoris, superior and inferior gemellus, tensor fasciae femoris, popliteus, plantaris, flexor longus digitorum, flexor

brevis digitorum, flexor longus hallucis, flexor brevis hallucis, abductor hallucis, biceps femoris, obturator internus, soleus, pyriformis, abductor minimi digiti, abductor, transversus and obliquus hallucis, interossei muscles.

The 2nd Sacral Nerve.—Gemellus superior, obturator internus, gluteus maximus, semitendinosus, soleus, flexor longus hallucis, pyriformis, gastrocnemius, abductor minimi digiti, abductor, transversus and obliquus hallucis, biceps femoris muscles.

The 3rd Sacral Nerve.—Center for erection and ejaculation.

The 4th Sacral Nerve.—Center for sphincters of anus and bladder.

Specific Centers.—The subjoined table gives the vertebrae which will be found subluxated in disordered states of the structures named. These centers represent the findings in the majority of cases only. The vertebra above or below the one listed here may in certain cases be subluxated, owing to the existence of communicating fibres and the diffusion of impulses which may extend for one or two segments upward or downward in the cord. In the main, however, the centers here given represent the findings in disease of the structures opposite which they appear.

Scalp—1 to 4C, 6 and 10D.
Face—1 to 4C, upper and 10D.
Neck—1 to 4C, upper and 10D.
Brain—1 to 4C, upper and lower D.
Eye—1 to 4C, 5 and 10D, 1 or 2L.
Ear—1 to 4C, upper D.
Nose—1 to 4C, 5 and 10D.
Pharynx—Upper and lower C, lower D.
Tonsils—Upper and lower, C, 5 D.
Larynx—1 to 4C, 5 D.
Tongue—1 to 4C, 5 D.
Teeth—3 or 4C, 5 D.
Mouth—3 to 4 C, 5 D.
Thyroid—6 C, 6 D.
Mamma—6 or 7 C, 2 to 6 D.
Heart—1 to 4 C, 2 D.
Lungs—1 to 4 C, 3 D.

Bronchi—1 or 2 D.
Peritoneum—11 or 12 D, 1 or 2 L.
Diaphragm—3 to 5 C, middle D.
Liver—4 and 8 D.
Spleen—6 and 9 D.
Pancreas—8 or 9 D.
Stomach—1 to 4 C, 5 to 7 D, 11 D.
Large Intestine—1 or 2 L.
Small Intestine—11 or 12 D.
Appendix—2 L.
Rectum—4 or 5 L.
Kidney—10 D.
Suprarenal Capsule—9 D.
Bladder—1 and 4 L.
Uterus—4 L.
Prostate—1 and 4 L.
Ovaries—3 L.
Testes—3 L.
Vagina—4 L.
Penis—2 and 4 L.

Many chiropractors follow the table given below, and which conforms in most particulars with that listed above Each center is designated as "Place" in this table, and reference to the various centers is made by using the abbreviated term. For example, the eleventh dorsal vertebra is spoken of as "K.P.," meaning "Kidney Place." The various centers, with their abbreviation, follow:

1 C—Atlas Place (A.P.).
2 C—Axis Place (Ax.P.).
3 C—Upper Central Cervical Place (U.C.C.P.).
4 C—Central Cervical Place (C.C.P.).
5 C—Lower Central Cervical Place (L.C.C.P.).
6 C—Lower Cervical Place (L.C.P.).
7 C—Upper Arm Place (U.A.P.).
1 D—Arm Place (Am.P.).
2 D—Upper Heart Place (U.H.P.).
3 D—Lung Place (L.P.).
4 D—Heart Place (H.P.).
5 D—Stomach Place (S.P.).
6 D—Central Place (C.P.).

7 D—Liver Place (Li.P.).
8 D—Pancreas Place (P.P.).
9 D—Spleen Place (Sp.P.).
10 D—Upper Kidney Place (U.K.P.).
11 D—Kidney Place (K.P.).
12 D—Lower Kidney Place (L.K.P.).
1 L—Bladder Place (B.P.).
2 L—Upper Genital Place (U.G.P.).
3 L—Genital Place (G.P.).
4 L—Lower Genital Place (L.G.P.).
5 L—Rectal Place (R.P.).

CHAPTER IV

Vertebral Subluxations

As has been already stated, vertebral subluxations have been very little studied by the medical profession. The medical student does not make a dissection of the vertebral column, and therefore has only a general conception of this portion of the body. The average medical practitioner knows that a vertebra is composed of a body, an arch, intervertebral cartilages, and articular processes; he may be somewhat familiar with the ligaments of the spine, at least to the extent of holding to the erroneous view that they prevent under any and all circumstances the possibility of displacement of the vertebrae. Anatomists have taught for centuries that displacements of the vertebrae are a practical impossibility in the absence of fracture, and all who have followed in their wake have accepted these views as final, and made no personal investigations which might have changed these opinions.

The fact that slight displacements of the vertebrae not amounting to actual dislocations are possible in the spine has never been investigated, and these minor lesions of the vertebral column have therefore been left unrecognized until recent years. The greatest reason for the tardy acceptance of subluxations as a fact has been the firm adherence to the above views, and an entire unwillingness on the part of the profession to even consider the subject. This has been partly due to the fact that these views were originally put forth by men of very limited education along kindred lines, and who, while their basic principles were correct, made other erroneous statements in connection therewith, which naturally precluded the possibility of any recognition of their views by men versed in the science of disease. It is possible that had these same views been advancd originally by men of superior intelligence and attainments, speedy recognition of vertebral subluxations as a possibility and a factor in the production of disease would have been accorded them.

In the author's mind, therefore, it has been due to the failure of the medical profession to give the slightest attention to this field of thought, instead of giving it some consideration, that has resulted in constant denials of the possibility of subluxation of the vertebrae. Men who have not spent one moment's serious consideration of the subject of spinal adjustment deny that there is any truth or logic in the claims made by its advocates. On the contrary, those who do investigate the subject and give it serious thought and study, become convinced of the soundness of its theoretical basis.

The general opinion has been that by the term "subluxation" a dislocation is implied. Such a construction of this term is, however, erroneous, since it does not imply a complete disarticulation. It is freely admitted that a dislocation of a vertebra without fracture is hardly possible. But chiropractic does not claim to deal with dislocations of the vertebrae. When the word subluxation is used, it is meant to convey the fact that a slight change in the relative position of a vertebra to the contiguous surfaces of the vertebra above and the one below it has occurred. That is to say, instead of the entire surface area of a vertebra being approximated, with die-like precision and accuracy, to its fellows above and below it, it is slightly shifted from this position. There has simply been a shifting in the position of one vertebra upon another, and the greater portion of the surface area of the two vertebrae still oppose each other. This movement is in various directions depending upon the configuration of the articular processes of the vertebrae involved, upon the direction of any external forces which may have produced it, or upon the nature of the ligamentous contraction which has operated to draw the vertebra out of alignment. It is these various forms of displacements which we will consider in this chapter.

In the first place it must constantly be borne in mind that a certain change occurs in the ligamentous structures surrounding the vertebra which is subluxated, and also in the intervertebral cartilaginous disc. Without these changes subluxations are impossible. The vertebra must be looked upon as it is in situ, and not as it would be, disarticulated

from the balance of the spine, devoid of ligaments and of the cartilaginous disc. The failure to thus view the vertebra is what produces the opinion held even today by some chiropractors that the vertebra slips out of place in a certain direction, and an adjustment pushes it back into proper position. These operators have failed to recognize the physical factors entering into the production of vertebral subluxations and their correction by the thrust applied to the vertebrae. What really produces a subluxation is its displacement beyond a certain limit; and what reduces the subluxation is the return of the vertebra to its normal position by reconstruction of the ligaments and discs.

That property of ligaments and cartilage by which they possess their function of holding parts in position, and permitting of a certain degree of movement between these parts, is their elasticity. Were the ligaments of the vertebrae rigid bands instead of elastic fibres, and were the intervertebral cartilages solid plates instead of elastic discs, not the slightest movement between the various vertebrae would be possible. However, they are elastic, and it is the measure of their elasticity which determines the degree of movement which is possible between the vertebrae which they hold in apposition. When the limit of their elasticity is overcome and the force which is responsible for this is continued, they do not return to their former state when the force is finally removed, and the vertebrae remain in this position because the elastic limit of their ligaments and of the cartilages has been passed.

"The elastic limit of any material is defined as the point at which, under applied loads, the stresses are no longer proportional to the loads. Beyond the elastic limit of a material the deformation is no longer proportional to the applied forces, and upon removal of the forces, the material will not return to its original condition, but maintains a permanent set." (Dana). When, therefore, the ligaments of one side of the vertebrae are contracted and acting as a force which draws the vertebra toward the side on which they are situated, the ligaments of the other side are attached; if this stretching is beyond the limit of their elasticity, they will not return to their former position when the

force is removed, but become set. The contracted ligament remains in its contracted condition, and the vertebra is permanently drawn toward the contracted side.

The same principles apply to the intervertebral cartilages. If these structures are compressed beyond their limit of elasticity, they fail to resume their former shape when the force is removed, but remain set. If, for example, one side of a cartilaginous disc is compressed, it fails to return to its former thickness and remains permanently thinned. In this manner are produced the various forms of subluxation which result in a movement toward each other of the vertebrae between which the disc is thinned, and which produces a narrowing of the intervertebral foramen. This thinning of a disc may be on either side, at its interior or its posterior aspect. An evenly distributed compression of the entire disc beyond its limit of elasticity will result in an approximation of the vertebra above to the one below it, resulting in a narrowing of the intervertebral foramen on each side.

Besides compression of the discs as a result of applied forces, there is shearing or slipping. When pressure is brought to bear upon the two surfaces of an intervertebral disc, there may be a sidewise movement of the vertebra above or below it. This is a result of the shearing of the disc and an actual displacement can only be produced by such shearing of the intervertebral cartilaginous disc. The displacement of the vertebra may be to the right or the left, and anteriorly or posteriorly.

Finally there is one other force acting though the spine, namely rotation or turning. That the vertebrae normally turn upon their axis with reference to each other we know to be a fact, as it is witnessed in the lumbar region of the spine when the head and trunk are turned with respect to the hips, and each vertebra twists slightly upon its fellow. This turning movement produces a tension upon the ligaments on one side of the vertebra, and causes a change in the form of the intervertebral cartilaginous disc. If this turning movement should become extreme, and exceed the point of limit of elasticity of the ligaments and the disc, these structures will fail to return to their former state, and

the vertebra remains set in that twisted or turned position; in other words, it remains rotated upon its axis.

These various forms of displacement of the vertebrae do not occur in all regions of the spine, for the reason that the conformation of the articular processes in the different types of vertebrae will prevent movement of the vertebrae in some directions, while it favors movement in certain other directions. We thus find certain forms of displacement peculiar to certain sections of the vertebral column.

The next factor which has a bearing upon the nature of the subluxation in any section of the spine is the kind and the direction of the applied force. In subluxations produced reflexly the ligamentous contraction is most pronounced on one side, and consequently the corresponding side of the disc will be thinned or compressed, or shearing results and the vertebra is drawn to that side.

The various forms of subluxations which occur in the vertebral column in the manner above described may therefore be enumerated as follows:

Kyphosis	Left Lateral
Lordosis	Right Posterior
Scoliosis	Left Posterior
Anterior	Right Inferior
Posterior	Left Inferior
Inferior	Antero-Inferior
Right Lateral	Postero-Inferior

In addition to these, which may be termed simple subluxations, there may exist combinations of two or more simple subluxations, constituting compound subluxations. Many such combinations of the essential subluxations may occur, the following being the most usual:

Posterior+Right or Left Posterior.
Inferior+Right or Left Posterior.
Lateral+Right or Left Posterior.
Inferior+Posterior.
Lateral+Posterior.
Inferior+Lateral.
Anterior+Inferior.
Right or Left Inferior+Inferior.

Antero-Inferior+Posterior.
Lateral+Antero-Inferior.
Inferior+Antero-Inferior.
Antero-Inferior+Right or Left Posterior.
Postero-Inferior+Inferior.
Right or Left Posterior+Postero-Inferior.
Postero-Inferior+Right or Left Inferior.
Antero-Inferior+Right or Left Inferior.
Lateral+Right or Left Inferior.
Posterior+Right or Left Inferior.
Right or Left Posterior+Right or Left Inferior.

Kyphotic Subluxation.—Kyphosis is a backward bending of a section of the spine. This form of subluxation is not confined to a single vertebra but ordinarily involves a group of vertebrae, and is seen in connection with Pott's disease. A true kyphotic subluxation is produced by a change in the intervertebral cartilaginous disc, whereby its anterior portion becomes thinned, as a result of some destructive process, and the vertebrae are thus permitted to approach each other at their anterior aspect. This in reality is an antero-inferior subluxation, and would be so classed were the above condition confined to a single vertebra. This is, however, rarely the case, for the disease process which causes the thinning of the disc does not confine itself, as a rule, to one segment but involves several vertebrae before its progress is arrested.

In this form of subluxation the superior articular processes usually remain in their normal position, unless a group of vertebrae are involved, in which case there will be more or less displacement of both the superior and inferior articular processes. The spinous processes are thrown apart as a result of the separation of the posterior portion of each vertebra as the anterior portion of each vertebra more and more approaches that of its fellows. A similar condition of separation of the spinous processes might also occur as a result of a thickening of the posterior portion of the discs without any change in the thickness of their anterior portion, and produce a separation of the articular processes. Such a condition will not, however, produce an impingement

of the vessels and nerves passing through the intervertebral foramina, since their diameter remains unchanged. This form of subluxation is therefore of no importance from the standpoint of producing disease, but deformities of this nature should be corrected, since they cause a narrowing of the thorax and are thus apt to lead to pulmonary diseases. Such deformities are the usual condition which is present

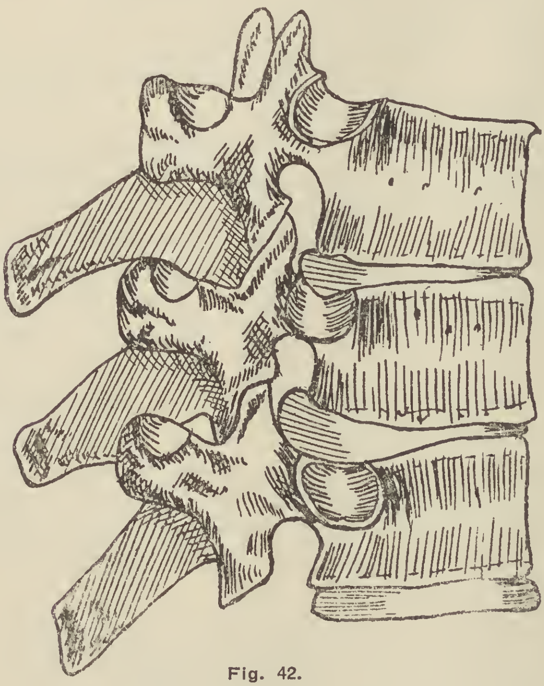

Fig. 42.
Kyphotic Subluxation.

in cases of "Round Shoulders," and the thickening of the posterior portion of the disc is due to the constant stretching of its posterior fibres by the habit of bending forward, which results in a species of hypertrophy of that portion of the disc.

In true kyphotic subluxations the vertical diameter of the intervertebral foramen is increased, while its anteroposterior diameter is diminished as a result of being encroached upon by the inferior articular processes of each

vertebra, and also by the protrusion of the posterior portion of the disc into it.

The kyphotic subluxations are seen most commonly in the dorsal region of the spine; very much less commonly in the lumbar region; never in the cervical region, unless a destructive process resulting from syphilis or tuberculosis has destroyed a portion of these vertebrae. Fig. 42.

Lordotic Subluxation.—Lordosis is a forward bending of a section of the spine, and is the opposite to kyphosis. Like kyphosis, lordosis is not limited to a single vertebra, but usually involves a group of vertebrae. A lordotic subluxation is produced by a thinning of the posterior portion of the intervertebral cartilaginous discs, and this permits the involved vertebrae to approach each other at their posterior aspect. The lordotic subluxation is in reality a group of postero-inferior subluxations, inasmuch as the posterior part of the intervertebral disc is compressed.

In this form of subluxation the inferior articular processes are displaced posteriorly, while the superior articular processes of the vertebrae below encroach on the intervertebral foramen. As a result of the thinning of the posterior portion of the discs the vertebrae approach each other posteriorly, and thus the spinous processes are thrown together.

Lordosis is usually met with as a result of a kyphotic subluxation, and since this form occurs most commonly in the thoracic region, lordosis is seen most often in the cervical and lumbar regions of the spine. The untoward effects of kyphosis must therefore be looked for in its associated lordotic displacements, as the loose capsular ligaments permit a forward movement of the superior articular processes of the involved vertebrae. A study of the placement of the articular processes of two vertebrae with reference to each other, with the spine in the vertical position, will show how easily such a condition may be produced; placing the spine in a horizontal plane, and again studying the placement of the articular processes will show how impossible it would be to cause any shifting of the vertebrae upon each other in this position. When the superimposed weight of the body is placed largely on the bodies of the vertebrae, the

inferior processes of the vertebrae are brought firmly up against the superior articular processes of the vertebrae below them, and no displacement can occur. If, however, the head and chest are thrown too far backward, and the weight is thrown upon the articular processes, the inferior articular processes will have a tendency to slide backward on the superior articular processes of the vertebra below, and in this way will force the latter forward into the inter-

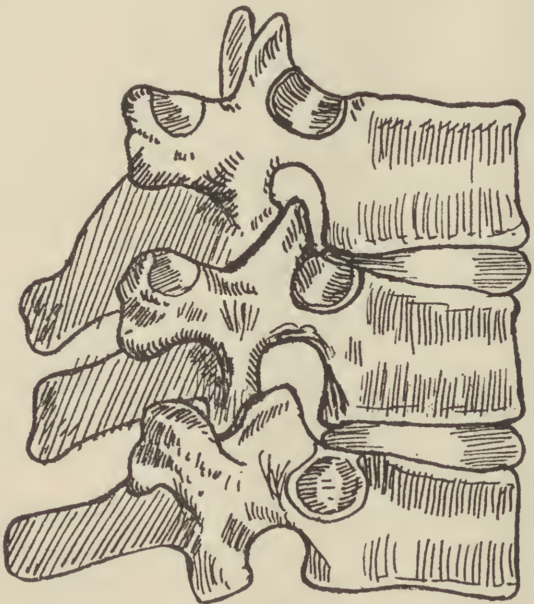

Fig. 43
Lordotic Subluxation.

vertebral foramen. Such a condition, which might be termed a "physiological lordosis" is seen very commonly in fleshy people who, in order to maintain their balance, lean backward and by so doing throw the lumbar portion of the spine forward. A careful study of Fig. 43 will show that this is mechanically correct.

In a lordotic subluxation the intervertebral foramen is increased in size vertically, but its antero-posterior diameter is diminished and the vessels and nerves which it transmits are compressed by being encroached upon by the superior articular processes. Fig. 43.

Scoliotic Subluxation.—Scoliosis is a lateral curvature of a section of the vertebral column, or of the entire column. True scoliosis is also not confined to a single vertebra, but involves at least three vertebrae. What might be termed a "physiological scoliosis" is commonly seen in individuals who use the right arm almost exclusively in their work, and as a result of the muscular contraction on the right side the spine is slightly drawn toward that side.

Scoliotic subluxation is due to a thinning of the lateral aspect of the intervertebral cartilaginous discs, which permits the sides of the bodies of a group of vertebrae to approach each other. As a result of this lateral approximation of the vertebrae the transverse processes on the contracted side are brought toward each other on that side, while on the opposite side they are widely separated. This results in a marked diminution in the vertical diameter of the intervertebral foramina on the compressed side. The spinous processes of the involved vertebrae are displaced laterally.

Scoliosis is seen in the cervical region of the spine in cases of wry-neck. It is, however, met with most commonly in the thoracic region. When the degree of scoliosis is very marked, a compensation curve in the cervical or lumbar region is produced, which gives the vertebral column the appearance of the capital letter S. Fig. 44.

Antero-Inferior Subluxation.—An antero-inferior subluxation implies a downward tilting of the front of a vertebra, due to thinning of the anterior aspect of the disc upon which it rests. It is a counterpart of kyphosis, with the exception that only one vertebra is misplaced.

This form of displacement is mistaken by many chiropractic writers for a posterior subluxation because the spinous process is found displaced backward. Comparison of the spinous process with the one above will show that it occupies a position in close contact with the latter, a condition that would not obtain in a direct posterior displacement of a vertebra.

Recognition of the antero-inferior subluxation thus explains the posterior position of a spinous process so often noted on palpation. And the reason that a downward tilt

of the anterior aspect of the body of a vertebra causes the spinous process to project backward is the sloping direction of the latter. When the front of the vertebra is tilted downward the spinous process is brought into a more horizontal position and this naturally causes its extremity to extend beyond that of the spinous process above and below it.

The transverse processes of the vertebra are carried forward and upward, and are less palpable than those of the adjacent vertebrae.

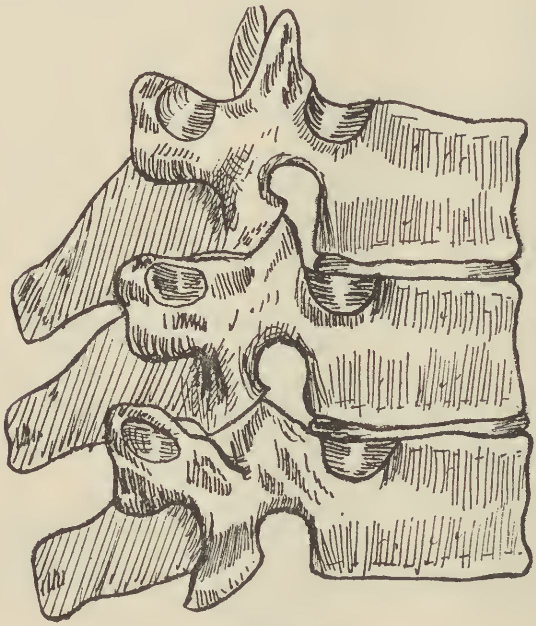

Fig. 44
Scoliotic Subluxation

The superior articular processes of the displaced vertebra are carried forward and encroach on the diameter of the intervertebral foramen above the displaced vertebra. Fig. 45.

The antero-inferior subluxation is seen with greatest frequency in the dorsal spine, less commonly in the lumbar spine, and least often in the cervical region. Habitual stooping, especially that made necessary by certain occupations, is largely responsible for this displacement. Under such

circumstances a certain disc which does not have the requisite amount of elasticity fails to return to its original condition on removal of the forces applied to it, and gradually a permanent thinning of its anterior portion follows. This process extends over a long period of time and is progressive. The thinner the front of the disc becomes, the more the vertebra which it supports tilts downward anteriorly, until finally the articular processes are brought forward so far into the lumen of the intervertebral foramen that they impinge its contents.

Postero-Inferior Subluxation.—By the term postero-inferior subluxation is meant a downward tilting of the back portion of the body of a vertebra in consequence of a thinning of the posterior aspect of the disc upon which it rests. This form of displacement is a counterpart of lordosis.

The anterior position of the spinous process causes this form of subluxation to be designated an anterior subluxation by some writers. While it is true that some give the name anterior to such a displacement simply because the spinous process is forward, such a term is undesirable because it does not refer to the position of the vertebra as a whole. The term postero-inferior is much more explicit inasmuch as it denotes the precise position of the vertebra.

When the back portion of a disc is thinned, and the posterior aspect of the body of the vertebra tilts downward in consequence thereof, the spinous process is misplaced downward and forward. When the back portion of the body of a vertebra is tilted downward the spinous process assumes a more vertical position, and this carries its tip forward. At the same time it is brought into closer apposition with the spinous process of the vertebra below.

The transverse processes are carried downward and backward and are more palpable than those of the adjacent vertebrae.

The inferior articular processes of the subluxated vertebra move downward upon the superior articular processes of the vertebra below, thus narrowing the vertical diameter of the intervertebral foramen. Sufficient force may be brought to bear upon the superior articular processes of the vertebra below the one that is subluxated to cause them to

be moved forward, thus reducing the antero-posterior diameter of the intervertebral foramen.

This form of subluxation is frequently the result of direct violence, and is usually caused by a fall, blow, or kick. It also occurs in persons who bend the spine forward when in the upright position, and carry the weight of the body more on the articular processes than on the bodies of the verte-

Fig. 45
Antero-Inferior Subluxation

brae. This is seen particularly in individuals with a pendulus abdomen. The condition is progressive and its development extends over a considerable number of years. It may occur in any region of the spine, but is met commonly in the lower dorsal and lumbar region. Fig. 46.

Inferior Subluxation.—This form of subluxation is, as its name implies, one in which a vertebra is displaced in a downward direction. Such a downward displacement of

the vertebrae is due to a diminution in the thickness of the disc upon which the vertebra rests, causing it to approach the vertebra below, and thus produce a decrease in the vertical diameter of the intervertebral foramina between them.

The thinning of the disc is produced by interference with its nutrition as a result of a contracted condition of the ligaments on both sides of the vertebra which is brought about by reflex impulses from some diseased part of the body. The disc is thus affected not alone by the pressure thus ocassioned, but also by reason of the interference with its nerve and blood supply as a result of the narrowing of the vertical diameter of the intervertebral foramen.

A degenerative process, as a result of a syphilitic or tubercular infection could also produce a destruction of the disc; these disease processes, however, also invade the bone, and more especially the anterior or more cancellous portion, and would also not be limited to a single vertebra, but involve a group, in which case there would be one of the forms of subluxation above described.

In a true inferior subluxation the vertical diameter of the intervertebral foramen on each side is diminished, and the openings are sufficiently occluded to permit of impingement of the structures transmitted by them. As the disc becomes more and more thinned, the body and pedicles of the vertebrae approach each other more closely. The inferior articular processes of the vertebra above the thinned disc glide downward on the superior articular processes of the vertebra below, and as they do so, force the latter forward into the intervertebral foramina on each side. The degree of closure of the foramina will of necessity depend upon the extent of thinning of the disc, and will be extreme if the entire thickness of the disc has been destroyed. If complete destruction takes place so that the bodies of the two vertebrae are in direct opposition, ankylosis will develop as it would in any point in the body. Before this takes place, however, nature produces a forward bending of the spine in the affected region to prevent complete occlusion of the intervertebral foramina, just as occurs in old age when settling of the spine commences, and which is a counterpart of

an inferior subluxation, except that all the vertebrae are affected in the settling incident to old age.

Inferior subluxations are met with in all regions of the spinal column. They are least noticeable in the cervical region, for the reason that here the intervertebral discs are normally not very thick; in the lumbar region they are most pronounced since here the discs are very thick in comparison to those of the other regions. Fig. 47.

Fig. 46
Postero-Inferior Subluxation

Right or Left Inferior Subluxation.—This form of subluxation is a counterpart of the scoliotic subluxation, with this exception, namely, that in scoliosis a group of vertebrae are involved, while in a right or left inferior subluxation only one vertebra is affected. That is to say, in scoliosis several discs are compressed laterally, whereas in a right or left inferior subluxation only one disc is so compressed. This form is called "right superior" or "left superior" by

some authorities; but the writer prefers the term "inferior," since this has reference to the side on which the producing lesion, namely, the reduced thickness of the disc, exists.

As a result of the thinning of one of the discs at its lateral aspect, the vertebra which rests upon that disc approaches its fellows on that side, bringing the transverse processes close to each other; on the other side the disc retains its normal thickness, or is even thicker than normal, owing to the extension which ensues upon that side as a result of the compression on the other side, and the transverse processes are farther apart than normal.

The intervertebral foramen on the compressed side will be much decreased in size vertically, while on the opposite side the foramen is enlarged. The impingement of the vessels and nerves thus occasioned will produce serious consequences. The innervation to the parts supplied by the affected segment of the cord will be interfered with as a result of the compression of the spinal nerve as it passes through the foramen. The compression of the arteries and veins passing through the foramen will produce congestion and irritability of the segment of the spinal cord, and also interfere with its nutrition, so that the reactions which take place there under normal conditions do not now occur.

If the right or left inferior subluxation is situated in the cervical region there will be in addition to the impingement of the spinal nerves compression of the vertebral arteries. The costo-transverse processes are displaced downward and press upon the vertebral artery below, which results in a multiplicity of cranial disturbances due to the vasomotor effects, since the vertebral arteries afford part of the blood supply to the brain.

The right or left inferior subluxation is produced as a result of a contraction of the ligaments on one side of the vertebra, which produces an approximation of the vertebrae of the corresponding segment. This contracted condition of the ligaments is occasioned by excessive impulses from a diseased portion of the body, which reflexly produce excessive outgoing impulses causing a contraction of the spinal ligaments of the segment at which the ingoing impulses entered. As will be remembered, it was stated in the consideration of

the reflex production of subluxations that the efferent impulse of a reflex act affects principally the muscles of the same side on which the afferent impulse entered the cord; consequently the spinal muscles and ligaments on one side will be contracted, which will compress the disc on that side; if this compression is carried beyond the limit of elasticity

Fig. 47
Inferior Subluxation

of the opposite side of the disc, a permanent thinning will be produced.

This form of subluxation may also be a result of improper posture over long periods of time and of direct traumatism, and the fact that the spinous and transverse process on one side are out of alignment is positive evidence that the centrum or body of the displaced vertebra is also moved downward on the compressed side. Fig. 48.

Lateral Subluxation.—A lateral subluxation is one in which a vertebra is displaced to either the right or left. In

a true lateral subluxation there is no turning or tilting of the affected vertebra. There may, however, be an apparent lateral deviation of a vertebra. Such a condition is produced by a unilateral contraction of the ligaments and muscles of two vertebrae, which, by drawing the vertebra toward that side as a result of compression of the disc, would simulate a direct lateral deviation of the vertebra involved. Such a condition could, however, be differentiated from a true lat-

Fig. 48
Right Inferior Subluxation

eral subluxation by the fact that in the former the transverse processes approach each other, while in a true lateral subluxation the distance between the transverse processes on each side is the same.

This form of displacement is met with most commonly in the dorsal region, and occurs most readily between the tenth and eleventh, and the eleventh and twelfth vertebrae, since these are not reinforced by the ribs. It however,

occurs in all thoracic vertebrae because the surface of their articular processes is flat. In the lumbar region lateral displacement of the vertebrae is impossible on account of the strength of the capsular ligaments, and the fact that the superior articular processes so completely surround the inferior processes of the vertebra above. In the cervical region lateral displacement is possible but not common. Owing to the manner in which the bodies of these vertebrae

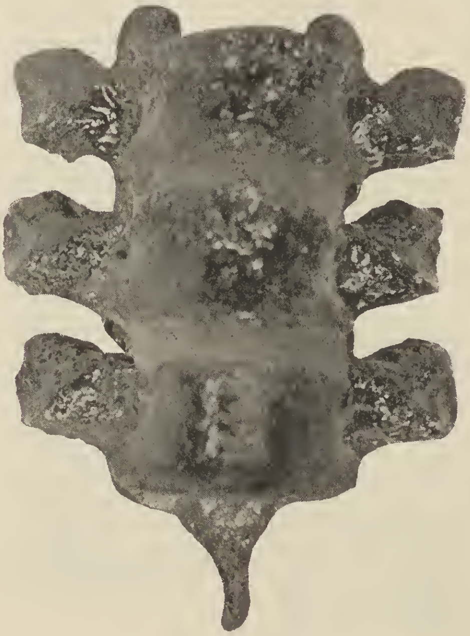

Fig. 49
Lateral Subluxation

articulate, any lateral deviation of a cervical vertebra is usually accompanied by a certain amount of rotation.

For the production of a lateral subluxation, even in the cervical region, quite a degree of violence would be necessary; this is true for the reason that the upper surface of the body of these vertebrae is concave transversely, and presents a projecting lip on each side; the lower surface is convex from side to side, and presents laterally a shallow concavity which receives the corresponding projecting lip

of the adjacent vertebra. For this reason there would be more likely to occur a rotation of these vertebrae with a gliding of the surfaces of the articular processes over each other. In such a case the spinous processes would be displaced laterally and give the impression that the vertebra was displaced to the side. To determine whether this is the case, or whether the vertebra is actually displaced laterally, the transverse processes should be palpated. If the vertebra is not rotated, the transverse processes will be on a level with each other, whereas when the vertebra is rotated, the transverse process on one side will be posteriorly displaced while the transverse process on the other side is displaced anteriorly, depending upon the direction of the rotation.

Subluxations which, from the position of the spinous process are apparently lateral, are consequently in most cases either right or left inferior or right or left posterior subluxations or a combination thereof. Fig. 49.

Anterior Subluxation.—An anterior subluxation is one in which a vertebra is anterior to its adjacent vertebrae. This form of subluxation is rare, but the atlas and fifth lumbar vertebrae are found subluxated in this manner more often than any other vertebrae.

In the thoracic region the surfaces of the articular processes are placed against each other in such a manner as to practically preclude the possibility of a forward misplacement of one of the vertebrae in this region. There are, however, cases in which by palpation of the spinous and transverse processes a vertebra in this region is found to be anterior, but this is usually a thinning of the posterior portion of the disc as a result of which the posterior part of the vertebra which rests upon that disc is misplaced downward, while its anterior portion is raised; thus the spinous and transverse processes will be felt as being close to those of the vertebra below the one affected (posterior-inferior subluxation).

In the lumbar region of the spine the length of the inferior articular processes, and their convex surface fitting into the concavity on the tip of the superior processes of the vertebra below, effectively prevent any forward displacement of a vertebra in this region. The fifth lumbar verte-

bra is, however, an exception to this rule. This vertebra is wedge-shaped, the thicker portion of its body being anterior. This naturally will favor a forward displacement of this vertebra.

The most likely place in which a pure anterior displacement of a vertebra could occur is, therefore, at the atlas.

Fig. 50
Anterior Subluxation

Here a laxity of the transverse ligament will permit a forward displacement of the atlas upon the condyles of the occiput. It must be understood that by this only a slight displacement is implied, since a pronounced displacement would necessarily cause a compression of the medulla between the posterior arch of the atlas and the odontoid process of the axis.

It is often noted that an anterior displacement of the fifth lumbar carries the entire lumbar group with it, constituting what is known as spondylolisthesis.

Occasionally an apparent anterior displacement of the atlas is in reality a posterior displacement of the occiput. Palpation will in this case show the atlas properly related to the axis.

In an anterior subluxation the antero-posterior diameter of the intervertebral foramina is encroached upon and the nerves and vessels transmitted by them are compressed. When the subluxation affects the atlas, the vertebral arteries are also pressed upon, which interferes with the circulation to the brain. Fig. 50.

Posterior Subluxation.—In a posterior subluxation the inferior articular processes of a vertebra project backward from the superior articular processes of the vertebra below it. This displacement almost entirely occludes the intervertebral foramen, compressing the structures passing through it. The surrounding ligaments are contracted; the stellate and other ligaments connecting the ribs with the vertebrae share in this contraction. While in a posterior subluxation all the ligaments are not always affected, they might be. If the displacement is marked, the anterior and posterior, the flava, and the ligaments of the spinous processes will all be involved. The ligamenta fiava, which connect the laminae, can be readily palpated.

Posterior displacement of a vertebra is limited to a certain extent by the superior articular processes of the vertebra below the one displaced pressing against the posterior part of the vertebra above, or the one which is displaced. In some cases, however, the capsular, anterior, and posterior ligaments have become so lax that they permit of an almost complete backward displacement of the vertebra.

The gravity of this form of subluxation is still more apparent when it is noted that almost invariably when a posterior subluxation is present, such destructive changes occur in the intervertebral disc that a compression subluxation nearly always accompanies it.

Palpation of the spinous process, only, often leads to the erroneous diagnosis of a posterior subluxation, because of the backward extension of the spinous process so often noted. Palpation of the transverse processes prevents such mistakes because they will be found forward, a position that

obviously excludes backward displacement of the vertebra, and indicates an antero-inferior subluxation, q. v.

Posterior subluxations occur more frequently in the lumbar than in the cervical or dorsal regions of the spine. This is due to the fact that the flat surface of the articular processes in the cervical and dorsal region are placed in close opposition and permit of very little forward or backward

Fig. 51
Posterior Subluxation

movement. In the lumbar region, however, the concave-convex surfaces, greater size, and larger amount of cartilage makes possible a backward displacement within certain limits.

These subluxations are usually a result of an injury, or are produced by occupations which require a constant stooping position.

The intervertebral foramen is diminished in size antero-posteriorly, by the backward displacement of the body of

the vertebra which forms the anterior wall of the foramen. The transverse processes are also displaced backward equally on each side, while the spinous process of the affected vertebra projects beyond that of the vertebrae above and below. Fig. 51.

Right or Left Posterior Subluxation.—This form of subluxation is a displacement of a vertebra which consists in a turning of the vertebra upon its axis. As a result of this turning or rotation, the spinous process of the involved vertebra will be found to the right or the left of the spinous process of the vertebra above and the one below it, depending upon the direction of the rotation. The transverse process on one side is displaced posteriorly, while that on the other side is displaced anteriorly. The position of one transverse process posteriorly gives this form of subluxation its name. If the vertebra is so rotated that the right transverse process is posterior it is known as **a right posterior;** if the left transverse process is posterior it is known as a **left posterior.**

This turning of the vertebra produces a drawing out of alignment of the intervertebral disc, and a tension upon the various ligaments anteriorly, posteriorly, and laterally.

The articular processes are displaced posteriorly on one side, and to the side toward which the vertebra is rotated, thus producing what may correctly be designated as a lateral-posterior. This form of subluxation is frequently associated with scoliosis.

Rotation subluxations are possible in all regions of the spine, but occur with least degree in the cervical region, as the vertebrae in this region are so constructed with a downward tilt of their transverse processes, and a flange at the sides of the upper surface of their body that they are well protected against any radical rotation. The normal spine permits considerable rotation in this region without displacement, but this movement is confined principally to the rotation of the atlas upon the odontoid process of the axis; the other cervical vertebrae rotate en masse, the rotation of each individual vertebra being relatively slight, as a rule. However, the rotary displacement in this region may be-

come pronounced when associated with one of the other forms of subluxation, especially a right or left inferior.

In the lumbar region there may exist also a turning of a vertebra upon its axis sufficient to amount to a right or left posterior subluxation.

A right or left posterior subluxation is of great fre-

Fig. 52
Right Posterior (Rotary) Subluxation.

quency in the dorsal region of the spine; in fact, one of the commonest of all forms.

Owing to the posterior and lateral displacement of the articular process on one side in this form of subluxation the antero-posterior and lateral diameters of the intervertebral foramen on that side will be encroached upon and impingement of the vessels and nerves passing through it will result. Fig. 52.

Subluxations in the Various Regions of the Spinal Column.—We have seen that certain subluxations are peculiar

to certain regions of the spine, for various reasons, while these same subluxations for the same reason are impossible of occurrence in other regions of the spine.

Grouped according to the regions in which the different forms of subluxations are met with, we find that the following regions permit of these forms of displacements:

Region of Spine	Forms of Subluxations
Cervical.	Kyphotic (primary).
	Lordotic (secondary to kyphotic).
	Scoliotic (physiological or pathological).
	Inferior.
	Lateral.
	Anterior (Atlas).
	Right or Left Inferior.
	Right or Left Posterior.
Thoracic.	Kyphotic.
	Primary Lordotic.
	Scoliotic.
	Inferior.
	Right or Left Inferior.
	Lateral.
	Right or Left Posterior.
	Antero-Inferior (upper dorsal spine).
	Posterior-Inferior (lower dorsal spine).
Lumbar.	Kyphotic.
	Lordotic (secondary to kyphotic).
	Scoliotic.
	Inferior.
	Right or Left Inferior.
	Anterior (5th especially).
	Posterior.
	Right or Left Posterior.
	Antero-Inferior.
	Posterior-Inferior.

The following table shows the regions of the spine in which the various forms of subluxations may occur:

Posterior	Lumbar region.
	Thoracic region.

Kyphotic	Thoracic region (especially). Lumbar region. Cervical (rarely).
Lordotic	Primary, Thoracic region. Secondary to kyphotic, Cervical and Lumbar regions.
Scoliotic	Primary, Thoracic region. Compensatory, Cervical and Lumbar regions.
Inferior	Cervical region. Thoracic region. Lumbar region.
Right or Left Inferior	Cervical region. Thoracic region. Lumbar region.
Lateral	Cervical region (usually combined with rotation). Thoracic region (especially the 11th and 12th).
Anterior	Cervical (Atlas). Fifth Lumbar (spondylolisthesis).
Right or Left Posterior	Cervical region. Thoracic region. Lumbar region.
Antero-Inferior	Dorsal region. Lumbar region.
Postero-Inferior	Dorsal region. Lumbar region.

Compound Subluxations.—As stated above, these are combinations of the simple forms of subluxation described, and require no especial description. Compound subluxations are usually the only kind found, since, as already mentioned the vertebra is also displaced posteriorly in nearly all other forms of displacement. A lordotic and an anterior subluxation are the only ones in which a backward displacement of the affected vertebra does not occur in combination with the displacement in other directions.

CHAPTER V

Spinal Analysis

Having studied the different types of subluxations, it now becomes necessary to consider the various methods which are used for the detection and determination of these displacements.

For the purpose of making a correct spinal analysis it is necessary, first of all to become familiar with the signs of vertebral subluxations. These signs and symptoms are invariably present wherever a subluxation exists. After having determined that a subluxation is present in a certain spinal segment, it next becomes necessary to use those methods which will show what the exact nature of the displacement is. It is only through such a knowledge that we are enabled to apply the proper thrust for the reduction of a subluxation.

Under the chapter on spinal symptomatology the signs of vertebral subluxations were described, and the manner of eliciting these signs will be considered in this place.

Signs of Vertebral Subluxations

The symptoms and signs indicating subluxation of a vertebra are the following:

1. Pain.
2. Tenderness of the nerves.
3. Thickening of the nerve-sheath.
4. Variation in temperature.
5. Disturbed function.
6. Contracted ligaments.
7. Diminished mobility of the back.
8. Changes in the anatomical structures connected with the spine.
9. Mal-alignment of the spinous processes.
10. Mal-alignment of the transverse processes.
11. Mal-alignment of the articular processes.

These symptoms and signs are at times difficult to determine, owing to the excessive muscular development of some patients, and the amount of adipose tissue which intervenes between the bones of the spinal column and the integument. Usually, however, these disadvantages are not sufficiently marked to entirely prevent remaking of a correct spinal analysis.

Pain.—This is an unfailing symptom of subluxation, and points undeniably to some lesion of a nerve. The pain is not located at the point of the subluxation, but is referred to the peripheral distribution of the nerve which takes its origin in the spinal segment which is involved by the subluxation. Pain, being a subjective symptom, its presence can only be determined by questioning the patient. After the location of the pain has been ascertained the segment controlling that part of the body is examined, and invariably a subluxation of the vertebra in that segment will be found.

Tenderness of the Nerves.—When a subluxation exists between two vertebrae, there will be a hypersensitive area found in the corresponding spinal segment, which is produced by the impingement of the spinal nerve. By palpating along the laminae this tenderness of the nerve is readily elicited, and the patient complains of pain. On finding the point of greatest tenderness, the end of the index finger should be pressed down between the transverse processes, as this will bring it into contact with the posterior primary division of the spinal nerve, as it passes backward, and before it gives off its internal and external branches.

Thickened Nerve-sheath.—The sheath which contains the spinal nerve and the blood-vessels is usually found to be thickened and congested as a result of impingement. This thickening of the nerve sheath is readily determined by passing the index finger downward along the laminae, when the nerve will be felt to roll beneath the finger. At all places where such a condition of the nerve sheaths obtains, a subluxation will be found. At times it is rather difficult to palpate the nerve, especially if the overlying muscles are large or if there is present a marked contraction of the spinal ligaments. Ordinarily, however, the thickened nerve may be

palpated by pressing aside the muscles and ligaments. When in addition to tenderness is found, it may be assumed that the cord which rolls beneath the fingers is the nerve.

Variations in Temperature.—In the chapter on spinal symptomatology we saw that whenever a subluxation is present in a certain spinal segment, the cutaneous surface over that segment will be found to be of a higher temperature than that over the segments above and below it.

Whenever a spinal nerve is irritated the temperature of the spinal segment which it controls is increased. This is a positive indication that a subluxation exists at that point.

The temperature of the different sections of the back is determined by gently placing the palmar surface of the hand over the spine, commencing in the upper thoracic region, and passing down the entire length of the vertebral column. Should there be an acute subluxation of a serious nature, the spine will be hotter at that point; if the subluxation is a chronic one, the spine will be cooler at that point. When a considerable area of the spine is involved in the abnormal condition, the spine will be found hot to the touch throughout its entire extent. Testing the temperature thus becomes a valuable means of locating an acute subluxation. This method of locating a subluxation is also known as the "Heat Test."

Disturbed Function.—One of the most positive symptoms or signs of vertebral subluxation is deranged function of a certain part, organ, or system of the body. This is true for the reason that the functional activity and organic integrity of every part of the body are dependent upon proper innervation of that part. If, therefore, abnormal functioning is present in any portion of the body, it is an indication that there exists at some point interference with the conduction of the nerve-impulses essential to proper and uninterrupted activity of such a part. The place at which this interference occurs is at the intervertebral foramen where the nerve passes between movable vertebrae. If symptoms referable to a certain organ of the body are present, and the spinal segments from which this organ receives its innervation are then explained, it will always

be noted that a subluxation of the vertebrae in that section is present.

Deranged function thus is a positive sign of subluxation of a certain vertebra when a certain organ is affected. It thus becomes just as possible to say with certainty that a subluxation will be found at a certain segment of the spine when it is known that a certain organ is affected, as it is to state that a certain organ is affected when a subluxation is found in the segment which controls that organ.

Contracted Ligaments.—As has been previously explained, no abnormal condition exists in the body for any length of time without the production of rigidity of the muscles in the vicinity of the lesion. So also, in the case of vertebral subluxations there is always found a contraction of the muscles and ligaments in the vicinity of the subluxated vertebrae. This contraction is sometimes due to the subluxation when the latter is produced by external influences; on the other hand, it may itself be the producing cause of the subluxation, as where displacements are produced reflexly. In any event, contraction of the ligaments in a certain spinal segment is a positive sign of the existence in that segment of a subluxation. If the muscles are hard and indurated, showing that they have been contracted for a prolonged period, it is an indication that the subluxation has existed for a long time; in other words is chronic. If, however, the ligaments are merely contracted, it shows that the subluxation is more recent, and therefore, acute.

Ligamentous and muscular contractions are detected by palpating the spine, by passing the fingers along the laminae.

If the muscular and ligamentous contraction is only on one side it will indicate that the vertebra is probably displaced toward that side. If the contraction exists on both sides of a vertebra, it is a sign that the vertebra is not displaced toward one side more than another. In this way contractures of the ligaments not only are a sign of a subluxation, but also assist in the determination of the nature of the vertebral displacement.

That contracted ligaments are a sign of subluxations and also a cause, is proven by the fact that as soon as a displacement of a vertebra is adjusted the contraction of the

ligament disappears. In fact, it is by relieving the contraction of the ligaments, in most cases, that we reduce the subluxation when the thrust is applied. It can be safely assumed that the majority of subluxations are either partly or entirely dependent for their existence upon contraction of the ligaments which normally hold the vertebrae in their proper position. It is this contraction which draws the vertebra out of alignment, and then makes the condition permanent because of the continuous contraction or because the ligament has been drawn beyond the limit of its elasticity and is unable to return to its original state. As a result of this contracted condition the vertebra remains in its abnormal position until the displacement is mechanically corrected.

Diminished Mobility of the Spine.—When a joint in any part of the body is diseased, rigidity of the surrounding muscles and immobility are invariably present. This is true also of the spinal column, and diminished mobility of the spine is one of the most certain and constant symptoms of a subluxation of a vertebra or group of vertebrae.

Various tests are used to determine subluxation of certain portions of the vertebral column by the degree of motion possible in them. The signs of subluxation in different regions of the spine are as follows:

Subluxation of the atlas is indicated by inability to execute the nodding movement of the head freely and painlessly.

Subluxation of the atlas is shown by inability to turn the head easily from side to side.

Subluxation of the other cervical vertebrae is determined by inability to flex and extend the neck freely and painlessly.

Subluxation of the thoracic vertebrae is indicated by increased prominence of one side of the trunk, diminished flexibility of a portion of the spine, or a deviation of the vertebral column toward one side, when the patient is instructed to bend the body forward and backward. These signs point to contraction of the ligaments and diminished mobility of the vertebral column, which are signs of subluxation. Should ankylosis of the bodies of the vertebrae be present, there will exist a space involving two or more

vertebrae, where the spinous processes do not separate, with the production of a sharp angle in the spine at the point where the ankylosis discontinues, in flexion and extension movements alike. To test still further for ankylosis, especially in the lower dorsal and upper lumbar regions, the patient should flex sideways, then rotate the body from side to side and backwards This test is positive, since the nature of the joints of the vertebral column should admit of a certain degree of movement in any direction in each joint, that is to the extent permitted by conformation of the bones and the limitations of muscular and ligamentous tension. A further test for ankylosis in the lower dorsal and lumbar regions is the following: Place the patient in the prone position, with the right hand of the operator placed under the anterior superior portion of the ilium of the opposite side to that on which he stands, and the heel of the left hand against the spinous processes nearest him, he draws the ilium towards himself and at the same time pushes the spinous processes in the opposite direction; if the vertebrae do not move laterally, it is a sign that lateral ankylosis is present. To determine ankylosis of the bodies of the vertebrae the left hand is placed on the tips of the spinous processes and pressure applied, while traction is made upon the pelvis with the right hand; if then the vertebrae fail to move, it indicates ankylosis of the bodies of the vertebrae. To determine the presence of ankylosis of the spinous processes, articular processes, or laminae the patient is instructed to bend forward while the operator places his finger tips in the spaces between the spinous processes; if the spines fail to separate, ankylosis is present.

Subluxation of the lumbar vertebrae is detected in the same manner as that of the dorsal region.

To determine whether an acute disease of the spine is responsible for the rigidity have the patient jump to the floor from a slight elevation, striking on his heels. If he experiences pain in the spine, it is a sign of a pathological condition in the spine.

Changes in the Anatomical Structures Connected with the Spine.—Changes in the height and prominence of the scapulae, the prominence of the angles of the ribs, and the

prominence of the iliac crests are signs of vertebral subluxation.

To ascertain any undue unilateral prominence of the angles of the ribs the patient is placed in the Adams position, namely, standing with the heels together, and the body bending forward until the head and trunk are horizontal, and with the arms hanging. The angles of the ribs are then left uncovered by the scapulae and any prominence on either side may be readily noted. Such unilateral prominence of the angles of the ribs indicates a rotation of the vertebrae on their axis.

Differences in the height of the scapulae or iliac crests are noted by having the patient in the erect posture either sitting or standing, with the arms hanging at his sides. It becomes necessary in these instances to distinguish between a tilted pelvis and subluxation of the innominate bone. This is done by drawing a line through the spinous process of the 4th lumbar vertebra and noting the position of the iliac crest with reference to this line. If one crest is above and the other below this line a tilted pelvis is present. If one is on the line and the other above or below an iliac subluxation exists.

Mal-alignment of the Spinous Processes.—The position of the spinous processes is a valuable sign of a subluxation. This is especially true in the cervical and lumbar region. In the thoracic region, however, the spinous processes may project from the union of the laminae at an abnormal angle. Palpation of the tips of the spinous processes may in such cases become misleading, and in any case is not to be entirely depended upon; confirmatory evidence must be obtained in all instances by palpation of the transverse processes. If it can be definitely ascertained that the spinous process of a certain vertebra is really out of alignment, then it becomes positive evidence that the vertebra of which it is a part is moved in its entirety, for one part of a vertebra can not be moved independently of its other portions.

Mal-alignment of the Transverse Processes.—The position of the transverse processes is a more positive indication of the presence and nature of a vertebral subluxation in any region of the spine than is that of the spinous processes.

Fig. 53
Palpation of Transverse Processes.

Palpation of the transverse processes is sometimes difficult in subjects who are very muscular or adipose, but after some experience in palpation this difficulty is overcome, and palpation of the transverse processes is readily performed.

Mal-alignment of the Articular Processes.—The position of the articular processes of contiguous vertebrae is necessarily altered when one of the vertebrae is subluxated. This change in position is particularly noticeable in the cervical spine in which region the transverse processes are so placed that their palpation is difficult or impossible.

Method of Palpation of the Spinous Processes.—In palpating the tips of the spinous processes one may commence either in the lumbar region and pass upward, or begin with the first thoracic vertebra and pass downward. Some prefer the former method, while others follow the latter procedure. There is no apparent advantage in either method, and it is largely a question of habit. Some find it easier to keep in mind the exact vertebra palpated by counting from below upward, while others find the downward palpation and counting more easy.

In palpating the spinous processes each one should be felt and its position compared with the one above and below.

The spine as a whole is then inspected with a view to determining the correctness of the findings on palpation, since inspection of the tips of the spines is often a more certain and accurate method than is palpation.

Method of Palpation of the Transverse Processes.—As mentioned above, excessive adiposity or great muscular development sometimes prevent the satisfactory palpation of the transverse processes. In such an event we must rely upon the palpation of the spinous processes and the finding of contracted ligaments on one side of the affected segment, and also tenderness of the nerve on that side.

In palpating the transverse processes some advise the use of the tips of the first three fingers of each hand; one finger being placed on a transverse process in such a manner as to enable the palpator to make comparison between three vertebrae. This method has its advantages in that

Fig. 54
The Adams Position.

the operator is enabled by this means to quickly make a diagnosis of the position of a vertebra with reference to that of the vertebrae above and below it.

It, however, requires much experience to become proficient in this method of palpation of the transverse processes. This is true for the reason that the ability to distinguish between the three distinct sensations of the three fingers used is acquired only after much practice by all operators, while some are never able to master it. The sensation is always more acute in one finger and palpation of a single vertebra at a time is therefore to be preferred. This is true especially in those who are learning spinal analysis, and in whose finger tips the sense of touch is not highly developed.

In our opinion, therefore, palpation of the transverse processes is best performed by using that finger in which the sense of touch is most highly developed, which varies in different individuals. In this way the transverse process of a vertebra can be palpated on each side and comparison then made with the ones above and below it. There is no special advantage to be derived in feeling the transverse processes of three vertebrae simultaneously. The index finger may, for example, be placed on the skin in such a manner that it can be made to glide over the transverse processes of three vertebrae in one movement by simply moving the skin along over the vertebrae. In this way differences in the position of the transverse processes of any of these three vertebrae will be readily noted.

Method of Palpation of the Articular Processes.—In the cervical spine palpation is largely limited to the articular processes because of the inaccessibility of the transverse processes. The patient should lie in the dorsal position with the head slightly elevated to relax the ligaments and muscles of the neck. The palpator should palpate with the tip of the middle finger, comparing the position of the articular processes of each side as well as their relation to those of the vertebrae above and below the one being palpated. A difference in the position of the articular processes is readily noted by this procedure and is positive evidence of subluxation of the vertebra.

Position of the Patient

In making examinations of the spine a certain definite procedure should be followed. The first essential to a thorough and complete examination of the spine is the proper position of the patient. Some displacements of the vertebrae are more recognizable in one position than another, and it therefore becomes necessary to place the patient in various positions in order that nothing may escape the attention of the examiner.

For the purpose of making a spinal analysis the following positions are the most useful:

The Erect position.
The Prone position.
The Dorsal position.
The Adams position.

The Adams Position.—In this position the patient stands with his heels together and bends forward without flexing the knees until the trunk is in a horizontal position, with the arms hanging.

With the patient in this attitude we note the position of the spinous processes, and observe any that may be out of alignment. Further, we note any diminution of mobility in any section or segment of the spine. If a certain section of the spine shows diminished elasticity, it is an indication of the presence of ankylosis; there will exist a space involving two or more vertebrae where the spinous processes do not separate, and there is evident a more or less sharp angle at the point where the ankylosis discontinues, which will also be true when the patient bends the trunk backward. To test still further for ankylosis, especially in the lower dorsal and upper lumbar regions, have the patient flex the trunk sideways, then rotate from side to side. This test is positive as the nature of the joints of the spinal column is such that they should permit of a certain degree of motion in any direction, in each joint, to the extent of the limitation due to contact of the bones and muscular and ligamentous tension. Diminished mobility of a certain segment of the spine indicates contraction of the ligaments of that particular segment. When the spine does not become flexed in a

perfectly straight line, it indicates a contracted condition of the muscles and ligaments on the side toward which the deviation occurs. Lastly this position will reveal any unilateral prominence of the angles of the ribs which is present when the vertebrae are rotated.

The Prone Position.—In this position the patient lies face down on a flat table. While in this position we note the position of the spinous and transverse processes. The temperature variations which are present are also noted with the patient in the prone position. Tenderness of the nerves, thickening of the nerve-trunks, and contractures of the ligaments of the spine are also palpated. This is the position which we have the patient assume for the purpose of palpation of the spine and parts associated therewith.

Further, a test for ankylosis is made with the patient in the prone position. Place the right hand under the anterior superior portion of the ilium of the side opposite to that on which the examiner stands. The operator then draws the pelvis upward and presses the spinous processes in the opposite direction; this will determine the presence or absence of ankylosis of the articular processes. To ascertain the presence of ankylosis of the bodies of the vertebrae place the left hand on the tips of the spinous processes and press downward, at the same time raising the pelvis with the right hand.

The Dorsal Position.—In this position the patient lies on a flat table on his back. This is the most suitable position for palpation of the cervical vertebrae. By flexing the neck and supporting the head with the knee the spinous processes can be easily palpated, and any changes from the normal in their position noted. The articular processes are next palpated with the index or middle finger.

The Erect Position.—The patient may either be seated upon a chair, or stand erect with his heels together and his hands hanging at his side. (Fig. 55.) The following observations are made with the patient in this position: The position of the spinous processes is first noted. The curves of the spine are also noted with the patient in this position, and viewed from the side. The angles of the ribs are observed, and any prominence of a certain rib due to a rotation

Fig. 55
The Erect Position.

of the vertebra with which it is connected noted with the patient erect. The comparative height and prominence of the scapulae is seen. The pelvic inclination and the comparative height of the iliac crests are noted with the patient in this posture.

Many chiropractors palpate all patients in the erect position. This is entirely satisfactory when the analysis is based solely on the position of the spinous processes. When, however, the transverse processes are palpated it is necessary that the patient be in the prone position so that the greatest relaxation of the muscular ligaments of the back may be obtained.

The Diagnosis of Subluxations

In addition to the symptoms and signs of subluxations which are subjective, and have already been described, three other methods are used for the determination of the exact nature of the subluxation. By the methods thus far considered we are enabled to say positively that a displacement of a vertebra is present; the direction of this misplacement can, however, only be determined by the following methods:

Inspection.
Palpation.
The X-ray.

Inspection.—By inspection we note the following points:

1. Mal-alignment of the spinous processes.

Lateral deviation of a spinous process indicates a lateral, right or left posterior, or right or left inferior subluxation. It is noted by viewing the patient from behind in the erect position, or looking at the spine with the patient in the prone position. Palpation of the transverse process will disclose which of these three forms exists. If a group of vertebrae are thus affected it indicates scoliosis.

Approximation of a spinous process with the one below it indicates an inferior or posterior-inferior subluxation. In the last-named form of subluxation the spinous process will be found forward as well as downward.

Backward deviation of a spinous process denotes a pos-

terior or antero-inferior subluxation. In the last-named type of displacement the spinous process will also be found close to the one above it. If a group of vertebrae are thus affected, it indicates kyphosis.

Forward displacement of a spinous process is a sign of an anterior or posterior-inferior subluxation. In the latter case the spinous process will be downward in addition to being forward. If there is a forward deviation of a group of vertebrae it means lordosis.

2. Diminished mobility of the back.

3. Undue prominence of the angle of a rib or number of the ribs.

If this prominence is bilateral it denotes a posterior subluxation or kyphosis.

When it is unilateral it indicates a right or left posterior subluxation or scoliosis.

When a rib or ribs are sunken in it means lordosis.

4. Tilting of the pelvis.

The pelvis is lower on the side toward which a scoliosis is directed.

Palpation.—By palpation we note the following:

1. Local zone of increased temperature, which points to the existence of a subluxation at that point, but does not give any clew as to the nature of the displacement.

2. Contraction of the spinal muscles and ligaments.

If this is unilateral, it denotes a deviation of the vertebra toward the side on which the contraction exists. There may thus be a lateral, right or left posterior, right or left inferior subluxation, or scoliosis in such a case.

If the ligamentous contraction is bilateral, it indicates either a posterior, anterior, inferior, kyphotic, or lordotic subluxation.

3. Tenderness on palpation of a nerve indicates a subluxation at the spinal segment from which that nerve arises, but affords no information regarding the nature of the vertebral displacement.

4. Thickening of the nerve-sheath, as felt on palpation, is also conclusive evidence of a subluxation at that segment but is of no value in determining the direction of the displacement of the vertebra.

5. Mal-alignment of the spinous, transverse and articular processes.—Palpation of the individual vertebrae is the most important method of determining the presence of a subluxation and its character.

Various methods have been devised for palpating the spinous, transverse and articular processes, none of which is perfect in itself, for the reason that method which suits one palpator will be impossible of use by another. In the author's opinion no set rule should be laid down for the method of palpating the vertebrae, but this should be left to the individual preference of the operator. We prefer the use of only one finger in palpation of the spine, since the sense of touch is more acute in one finger than when two or three fingers are employed at the same time.

The position of the patient is important. For palpation of the thoracic and lumbar vertebrae he should lie prone upon an adjustment table, the front section of which is slightly lowered. The portion of the table which supports the chest should be narrower than other parts of the table in order to permit the arms to hang vertically. The table should afford perfect comfort to the patient so that complete relaxation obtains. In palpating the cervical vertebrae the patient should be in the dorsal position, with the neck slightly flexed. (Fig. 58.)

Palpation of the spinous processes is a fairly reliable but not absolutely infallible means of determining the nature of a subluxation. This is true especially of the mid-dorsal region, where variations in the length and direction of projection of the spinous processes is noted quite often. There is an embryological reason for this. The spinous processes unlike the other parts of a vertebrae are not formed from a special center of ossification, and their size, shape, and direction of projection is therefore subject to variations from what is generally considered normal. The spinous processes are simply a backward extension of the laminae for the attachment of muscles and ligaments. Accordingly, were the tip of the spinous process to be taken as the only guide to the position of the vertebra it would lead to a considerable number of errors. This contention is fully borne out by findings in the dissection of human spines. We

Fig. 56
Prone Position—Palpation of Spinous Processes.

frequently find a spinous process that projects backward toward either side or in an upward or downward direction; the spinous process may have a clubbed end or an exostosis on one or the other side; it may be longer or shorter than normal. Palpation of such a spinous process would necessarily lead to erroneous conclusions regarding the position of the vertebra of which it is a part. It, therefore, becomes necessary to obtain confirmatory evidence as to the position of the vertebra by palpation of the transverse or articular processes. These are formed from a special center of ossification, and hence their size, form and position is not subject to the variations that may characterize the spinous process. From the foregoing we do not wish the reader to get the idea that palpation of the spinous processes is unreliable. It really is a reliable guide to the position of the vertebra in most instances. But palpation of the spinous processes should always be supplemented by palpation of the transverse or articular processes to corroborate the first findings and obviate any errors. The position of the spinous process gives the operator a good clue, as it were, to a subluxation; the second findings then confirm this clue or disprove it, as the case may be.

The following technic of analysis by palpation should, therefore, be followed: The patient should lie in the prone position, the analyst standing at the subject's left side. One finger of the right or left hand is placed on the spinous process of the first dorsal vertebra, and the next finger on that of the second dorsal vertebra. Their relative position is noted. If the spinous processes are in line it is assumed that the vertebrae are in their normal position. This assumption is then confirmed by palpation of their respective transverse processes. If the spinous processes are not in line it is assumed that one or the other vertebra is subluxated. To determine which is mal-aligned the spinous process of the seventh cervical vertebra must be palpated to note whether it is in line with the first or the second dorsal. If it is in line with the first dorsal, it must be assumed that the second dorsal is malposed. If the seventh cervical is in line with the second dorsal, it is assumed that the first dorsal is mal-aligned. For further confirmatory evidence the trans-

verse processes of these three vertebrae are then palpated and their relative position taken note of. If the first and second dorsals are in line the presumption is that they are not malposed. Both may, however, be coincidently displaced and to exclude this possibility their position in relation to the seventh cervical and third dorsal must be noted. Should it be found that the seventh cervical or the third dorsal is not in line with the first and second dorsal the position of the seventh in respect to the sixth cervical and of the third with the fourth dorsal must be determined. If the sixth cervical is in line with the seventh and the fourth dorsal is in line with the third, the first and second dorsals are malposed. But if the seventh cervical bears the same relative position to the sixth cervical that it does to the first and second dorsals it indicates subluxation of the seventh cervical; and if the third dorsal bears the same relation to the fourth dorsal that it does to the first and second dorsals it indicates subluxation of the third dorsal. The analyst must remember now that any of the three pair of vertebrae under inspection may be subluxated, and it becomes necessary to compare the position of these pairs with each other. If, therefore, the sixth and seventh cervicals and the third and fourth dorsals are in line, it means subluxation of the first and second dorsals; if the sixth and seventh cervicals and the first and second dorsals are in line it indicates subluxation of the third and fourth dorsals; if the first, second, third, and fourth dorsals are in line, it denotes subluxation of the sixth and seventh cervicals. Such a condition is, however, not common. Generally but one vertebra is subluxated. It is accordingly necessary to simply palpate the spinous processes until one is detected as being out of line. This spinous process should then be compared with the one below and above it, to make certain that it bears the same relative position to each. As previously stated, whenever a spinous process is not in line it points to subluxation of the vertebra of which it is a part; to certify this the transverse, or articular processes should then be palpated.

In palpating the transverse processes the palmar surface of the index-finger should be used. (Fig. 57.) The use of the three first fingers of each hand, placed on three vertebrae

at once is confusing, especially to the novice, and in fact requires long experience to educate the sense of touch in the three fingers to such a degree as to make it possible for one to interpret the three sensations simultaneously. The palmar surface of the index finger should be placed firmly over the transverse processes on either side of the spinous processes. The fingers should then be made to glide over three transverse processes in one movement, moving the skin along beneath them. In this way the position of three transverse processes is determined with reference to each other. Individual palpation of each transverse process may then follow, and the position of the transverse process on each side of the vertebra which is displaced should be determined for the purpose of ascertaining the exact nature of the subluxation. The following are the conclusions to be drawn from the position of the transverse processes:

When the transverse processes of a vertebra are displaced upward and forward to an equal extent on each side, it means an antero-inferior subluxation of the vertebra.

If the transverse processes are displaced downward and backward to an equal degree on each side, it signifies a postero-inferior subluxation of the vertebra.

When the transverse processes of a vertebra are displaced backward equally on each side, it indicates that the vertebra is displaced backward, and denotes a posterior subluxation.

If the transverse processes of a vertebra are displaced forward to an equal extent on each side, it indicates an anterior subluxation.

When the transverse processes project laterally so that the process on one side is drawn toward the line of the spinous processes while the one on the other side is drawn away from this line, a lateral subluxation is present. In this case the transverse processes are not turned or tilted, but are perfectly level.

If the transverse process on one side of a vertebra is displaced forward, while that on the other side is backward, it shows that the vertebra is turned on its axis, and a right or left posterior subluxation is present.

When the transverse processes of a vertebra are nearer

Fig. 57
Palpation of Transverse Processes.

the vertebra below than the vertebra above, it indicates that the upper vertebra is approximated to the one below it, and that the disc between them is thinned. This condition is known as an inferior subluxation.

If the transverse process of one side of a vertebra is nearer than normal to the corresponding transverse process of the vertebra below, a compression of that side of the intervertebral disc is present. The vertebra is nearer the vertebra on that side, while on the other side the distance between the two vertebrae is increased. This is known as a right or left inferior depending on which side the disc is thinned.

When the transverse processes of a group of vertebrae are displaced backward and are close to each other, a kyphosis is present.

When the transverse processes of a group of vertebrae are displaced forward a lordotic subluxation is indicated.

When the transverse processes are displaced toward the side, a scoliosis is indicated. A rotation subluxation is frequently associated with scoliosis, in which case there will be a backward displacement of the transverse process on one side.

Diagnostic Signs of Each Form of Subluxation

Antero-inferior Subluxation.—The spinous process is displaced upward and backward.

The transverse processes are displaced forward and upward to the same degree on each side.

The ligaments on both sides are contracted.

The nerve-sheaths are thickened.

There is tenderness over the nerves unless the subluxation is chronic.

There may be a local zone of increased temperature, particularly if the displacement is recent.

Disease in a certain organ, system, or part of the body.

The angles of the ribs may be carried slightly forward.

Postero-Inferior Subluxation.—The spinous process is displaced downward and forward.

The transverse processes are displaced backward and downward to the same extent on either side.

The ligaments of both sides are contracted.

The nerve-sheaths are thickened.

There is tenderness over the nerves unless the displacement is of long duration.

There will be a local zone of increased temperature if the displacement is recent.

Disease in the part supplied by the impinged nerve.

The angles of the ribs may be carried slightly backward.

Posterior Subluxation.—The spinous process is displaced backward.

The transverse processes are displaced backward to the same extent on each side.

The ligaments on both sides are contracted.

The nerve-sheaths on each side are thickened.

There is tenderness of the nerves on pressure, unless the subluxation is chronic.

There may be a local zone of increased temperature, especially if the subluxation is acute.

Disease in a certain organ, system, or part of the body.

Anterior Subluxation.—The spinous process is displaced forward.

The transverse processes are displaced forward equally on each side.

The ligaments on both sides are contracted.

The nerve-sheaths on each side are thickened.

There is tenderness of the nerves on each side, unless the subluxation is chronic.

There may be a local zone of increased temperature.

Disease in some organ, part, or system of the body.

Inferior Subluxation.—The spinous processes of two vertebrae are approximated, that of the subluxated vertebra downward upon the vertebra below.

The transverse processes on both sides of the vertebrae are approximated.

The ligaments on both sides are contracted.

The nerve-sheaths on each side are thickened.

There is tenderness of the nerves on each side unless the subluxation is chronic.

The temperature of the corresponding part of the back may be increased.

Disease in a certain part of the body.

Right or Left Inferior Subluxation.—The spinous process is displaced toward the side away from the side compressed.

The transverse process is displaced downward on the compressed side, while that of the other side is raised.

The ligaments on the side which is displaced downward are contracted; those on the other side are extended.

The nerve-sheath on the compressed side is thickened.

There is tenderness of the nerve on the side which is compressed.

The temperature of the zone supplied by the impinged nerve is increased.

Disease in a certain portion of the body.

Lateral Subluxation.—The spinous process is displaced to one side.

The transverse process projects laterally in the cervical region, and in the thoracic region the transverse process on one side is drawn away from the line of the spinous processes, while on the other side it approaches this line.

The ligaments on the side toward which the vertebra is displaced are contracted.

The nerve-sheath on the side toward which the vertebra is displaced is thickened.

There is tenderness on either side of the vertebra.

There is a zone of increased temperature corresponding to the segment supplied by the impinged nerve.

Disease in a certain portion of the body.

Right or Left Posterior Subluxation.—The spinous process is displaced slightly to one side.

The transverse process of one side is forward, while on the side on which the subluxation exists it is misplaced posteriorly.

The ligaments on the subluxated side are contracted.

The nerve-sheath on the subluxated side is thickened.

There is tenderness on the subluxated side.

The temperature of the corresponding segment of the back is increased.

The angle of the corresponding rib is displaced backward.

Disease in the parts supplied by the impinged nerve, depending on the location of the subluxation.

Kyphotic Subluxation.—The spinous processes are displaced and the distance between them increased.

The transverse processes are displaced posteriorly and separated.

The ligaments of the corresponding part of the vertebral column are contracted.

The nerve-sheaths are thickened.

There is tenderness.

The temperature of the part of the back affected is increased.

The angles of the ribs are prominent on both sides.

Mobility of the affected portion of the back is diminished or absent.

Lordotic Subluxation.—The spinous processes are displaced anteriorly and set close to each other.

The transverse processes on both sides are displaced forward and approximated.

The ligaments are contracted on both sides.

The nerve-sheaths are thickened.

Tenderness is present, unless the subluxation is chronic and the nerve is compressed.

The temperature of the corresponding portion of the back is increased.

Mobility of the affected part of the vertebral column is diminished or absent.

The pelvic inclination is increased.

Scoliotic Subluxation.—The spinous processes are displaced laterally.

The transverse processes are displaced to the side, and rotation of the vertebrae is frequently present.

The ligaments on the impinged side are contracted and indurated.

The nerve-sheaths on the subluxated side are thickened.

Tenderness is present unless the condition is chronic.

The temperature of the affected portion of the back is increased.

The angles of the ribs on the side toward which the lateral curvature is directed are prominent.

The pelvis is tilted up on the side toward which the curvature is directed and down on the other side.

The scapulae are affected in the same manner as the pelvis, namely that on the side toward which the scoliosis is directed they are raised, while the other is lowered.

Palpation of Various Vertebrae

Palpation of the Atlas.—The first vertebra to be considered is the atlas and its articulation with the occipital bone. Subluxation of this joint is very common, and at the same time of much importance by reason of its close proximity to the base of the nerve supply since the slightest displacement at this joint produces a disturbance in the innervation of the brain substance itself.

The condyles of the occipital bone are kidney-shaped, and convex antero-posteriorly, their posterior edge extending to about the middle of the foramen magnum and following the margin of the foramen for about one-sixth of its circumference, thus forming practically a centre of gravity on which to support the head. The articular surfaces on the lateral masses of the atlas are concave in the same direction that the condyles are convex, thus forming a U-shaped articulation from before backward, and constituting a perfect hinge-joint. Laterally, however, there is but limited motion. The same restrictions apply to rotation, yet there is sufficient motion possible to permit the occurrence of all the primary forms of subluxation.

The anterior, posterior, and lateral ligaments are mainly depended upon for the maintenance of the approximation of the surfaces of the bones forming this articulation, as the capsular ligaments are very loose. An anterior displacement of the occiput will be shown by a forward position of the chin. The production of this form of displacement is favored by irritation of the nerves which supply the sternomastoid and trapezius muscles, contraction of these muscles following.

There are also cases in which the jugular processes of the occipital bone and the mastoid processes of the temporal bone are ankylosed. Sometimes the atlas is ankylosed to the occiput, either entirely or in part, as a result of a de-

struction of the joint or to a faulty development of the atlas; in the latter instance the condition is congenital and cannot be corrected. Such conditions are to be suspected when the subject is unable to execute the nodding movements of the head and making lateral movements. Abnormalities of this kind should only be adjusted after a very careful examination has been made, as should the ankylosis involve the entire margin of the foramen and the anterior, posterior and lateral ligaments, we would question the advisability of breaking this union, because the most vital part of the spinal cord is encircled by this articulation. It must always be borne in mind that the ligaments of a joint are the real means of restraint of its movements, and it can therefore readily be seen what would occur in such a case as the above were the ligaments broken. The integrity of the joint would then depend upon the contraction of the muscles involved in the movements of the joint; in this case a complete dislocation would likely develop with compression of the medulla. Any form of subluxation of this joint will disturb the circulation and irritate the nerves of the brain and scalp.

The diagnosis of subluxation of the occipito-atlantal articulation is fortunately quite easy, as the body of the atlas is represented by the lateral masses, which set practically to the edge of the transverse processes of the other cervical vertebrae; since they are also placed just below the mastoid processes, the latter are taken as a guide to the detection and determination of subluxations of the atlas. Normally, both transverse processes should be equi-distant from the adjacent mastoid process. If one side presents a greater depression between the transverse process and the corresponding mastoid process than the other, a subluxation should be suspected. It is however, not uncommon for one transverse process to be more fully developed than the other; hence to avoid mistaking an overgrowth of bone for a subluxation, further comparisons must be made. Note whether or not the posterior tubercle of the atlas corresponds to the center of the occiput; then follow the posterior arch of the atlas around to the front and ascertain if it corresponds in prominence laterally and posteriorly to the corresponding surfaces of the occiput, bearing in mind the

different forms of subluxations possible. Attention must be given the fact that any turn of the head, if the articulation is normal, will change the relation of the lateral masses to the various points of comparison. If, further, the extreme movements of the joint can be executed without any sense of pain or discomfort, no subluxation exists. The muscles and ligaments immediately adjacent to the joint on the side on which the nerve is impinged are contracted. By pressing the index fingers up close to the occiput the subject will experience considerable tenderness. This tenderness is similar to that produced when the posterior branch of the spinal nerve is pressed upon in other regions of the spine. The recurrent branch of the meninges and the body of the vertebra arises by two roots, one from the spinal and the other from the sympathetic ganglion. The operator's fingers do not come into direct contact with this nerve as it is usually well protected by the jaw and the mastoid process; it is the posterior muscular nerve which branches from the same nerve that imparts the sensation. Pressure upon this nerve produces vaso-motor disturbances within the cord as well as in the meninges and bone.

In an occipito-atlantal subluxation the superior cervical ganglion is compressed by the transverse process and vasomotor changes in the vessels of the brain, eyes, and meninges result. Anemia or hyperemia of the brain will follow.

In a posterior displacement of the occiput on the atlas the same general rules must be followed, in fact this must be done in all cases regardless of the location of the displacement. The main points of comparison are the lateral masses of the atlas with the mastoid processes, the posterior arch, and the posterior tubercle of the atlas with the external occipital protuberance.

In making an examination for an occipital displacement the relation of the atlas to the axis must also be determined, as in such a subluxation there will be some displacement of the suspensory and check ligaments which connect the axis with the occiput. There will also be present the same contraction of the ligaments which unite the atlas and the occipital bone as are found in other regions of

Fig. 58
Palpation of Cervical Vertebrae.

the spine when the laminae are palpated. The unilateral contraction of these ligaments is readily determined.

It must be remembered further that the cartilage which separates the atlas from the occipital bone and from the axis resembles hyaline cartilage, and is not of the same fibro-cartilaginous quality as is that which composes the discs which are placed between the other vertebrae. In case of tilting or any displacements in which a space is left between the articular surfaces, the cartilage may thicken and when this occurs the displacement will resist correction for a greater length of time.

In a lateral displacement it will be found that the lateral mass on the side which is displaced laterally is beyond the mastoid process, while on the opposite side a space greater than normal exists.

In a right or left posterior subluxation of this joint the atlas is involved, and the superior cervical ganglion is influenced as a result of the continuous compression of the spinal nerves which communicate with it. This form of subluxation is brought about by a unilateral contracted condition of the rectus capitis anticus minor muscle which normally produces rotation, since it arises from the anterior surface of the lateral mass and the root of the transverse process of the atlas, and, passing upward and inward, is inserted into the basilar process of the occipital bone. Its proximity to the cervical ganglion will cause it to press upon this structure when it is contracted.

In palpating atlas displacements the peculiar construction of the atlas and its association with the axis should be kept in mind. There is always sufficient space laterally between the odontoid process and the lateral margins of the anterior arch of the atlas to admit of a lateral displacement great enough to produce serious results. Usually, however, the greatest lateral displacements at the occipito-atlantal joint are due to a slipping of the condyles upon the atlas, and not of the atlas itself upon the condyles. When the atlas is involved mostly, there will usually be also rotation.

Tilting forward of the atlas is also a serious form of displacement, and distinction must be made between a tilting of the occiput and that of the atlas. A tilting downward and

forward of the occiput is limited by the posterior arch of the atlas; but a tilting downward and forward of the atlas may occur without any displacement of the occiput; such a subluxation is made possible by a laxness of the transverse ligament, or by a persistent contraction of the anterior ligaments. A lack of tone in the sterno-mastoid or upper part of the trapezius muscles will also predispose to the production of this form of subluxation. The same comparison must be made as when the occiput is palpated. The relation of the transverse processes to the mastoid processes and to the transverse processes of the other cervical vertebrae should be determined. The posterior arch should be palpated in relation with the spinous process and laminae of the axis. Rotation is usually associated with atlas displacements and is indicated by a fullness on the side to which the subluxation is inclined. This is readily determined by palpation, and corresponds to the method of palpating the other vertebrae except that in this instance the posterior arch instead of the transverse processes and laminae is palpated.

Palpation of the Axis.—The most common form of subluxation of the axis is a right or left posterior. Lateral misplacement when present produces the greatest degree of irritation and congestion, as a result of pressure upon the nerves and blood-vessels emerging from the intervertebral foramina between the axis and third cervical vertebra. The manner of determining subluxations of the axis is the same as that employed in the examination of the other cervical vertebrae. The patient should be in the dorsal position. The spinous process of the axis is then located, and the laminae are followed forward until the articular processes are reached; these are then compared with the atlas and the third cervical vertebra. In this way lateral, right or left posterior, right or left inferior, inferior and scoliotic subluxations of this vertebra will be easily detected. Kyphosis and lordosis can be detected by inspection.

Palpation of the Other Cervical Vertebrae.—Subluxations of the cervical vertebrae can be detected in the same way as that just described under palpation of the axis. There will be, however, a slight difference imparted to the

touch by reason of the fact that in the axis the transverse processes spring from the base of the inferior articular processes, and owing to the absence of the costal process in this vertebra the groove between the costal and transverse processes is lacking; this difference is, however, of no practical importance. In palpating the articular processes the analyst should follow a line drawn from the mastoid process to the middle of the supraclavicular space. The sterno-mastoid muscle should be pushed slightly forward by the fingers down to the level of the fourth cervical. Below this point the sterno-mastoid is considerably anterior to the line of palpation. (Fig. 58.)

Palpation of the Thoracic Vertebrae.—In palpating the thoracic vertebrae one must not be misled by the position of the spinous processes, since, as previously mentioned, their angle of direction with the body of the vertebrae may be abnormal. Such an error may be avoided by palpating the transverse processes, and also noting the presence or absence of other signs of subluxation, as contracted ligaments, hyperaesthesia, and increased temperature.

The spinous processes of the upper thoracic vertebrae are longer than those of the lower, and therefore extend downward much farther from a line drawn horizontally through the transverse processes. This downward direction of the spinous processes of these vertebrae must be borne in mind in palpation; usually the transverse processes of a vertebra the spinous process of which has just been palpated are situated at the level of the spinous process of the vertebra above.

Another point to be remembered is that the transverse processes should follow gradually an oblique line from the upper thoracic vertebrae inward toward the spinous process of the twelfth thoracic vertebra. This line is formed by the gradual decrease in length of the transverse processes from the first to the twelfth. The transverse processes of the twelfth thoracic are usually very rudimentary, being merely a tubercle projecting backward and outward from the junction of the articular processes with the pedicles. The tenth thoracic also sometimes possesses such a rudimentary transverse process, from the upper surface of which a promi-

nent tubercle projects toward the spinous process of the vertebra above, as normally occurs on the twelfth thoracic vertebra. This tubercle is just posterior to the superior articular process, and may be present on the tenth, eleventh, or twelfth thoracic vertebra depending upon which is the transitional one.

Palpation of the Lumbar Vertebrae.—By examining the lumbar vertebrae the transverse processes will be seen to extend laterally and backward, while the articular processes project posteriorly. Palpation of the vertebrae in this region of the spine will be easy if the operator keeps in mind the characteristics of each vertebra. The transition from the lumbar to the sacral type will be noted from the fact that the inferior articular processes are much farther apart in the fifth than in the fourth vertebra. In palpating the vertebrae of the lumbar region, test for ankylosis between the fifth lumbar vertebra and the sacrum, and also remember the possibility of an individual first sacral vertebra.

The X-Ray in the Diagnosis of Subluxation.—In the determination of subluxations the X-ray is of great utility, and should be used whenever doubt exists as to the real nature of the displacement. The technique of the use of the X-ray cannot be given in a work of this kind, but the operator can become familiar with this by referring to any standard text on this subject.

Nerve Tracing

Nerve tracing is defined as "a mode of palpation used by the Chiropractor in following the course of tenderness along the track of a tender nerve or nerve fibre from its point of exit at the intervertebral foramen to its periphery where the incoordination is manifest; or it is a method of following that path from the periphery of the nerve, or nerve fibre, to its point of emission from the spinal cord through the intervertebral foramen."

The value ascribed to this procedure by its advocates is based on two main considerations: First, that the existence of an indistinct subluxation is demonstrated by tracing a tender nerve to the corresponding intervertebral foramen; second, that patients have greater confidence in the chiro-

practor if he is able to trace a tender nerve from the subluxated vertebra to the diseased organ.

The difficulties encountered in nerve tracing are summarized as follows: There may be a general hyperaesthesia "due to cord pressure"; nerve paths in the cords may be degenerated, as in tabes; cranial nerves being enclosed in bony canals and the body cavity makes their tracing impossible; an intervertebral foramen may be so large that the vertebra is subluxated without producing impingement on the spinal nerve, creating a condition of a vertebra being subluxated without tenderness of the nerve being present; the "internal" nerve supplying the viscera, as the heart, liver, stomach, cannot be traced throughout their entire path to such organs.

It is suggested that in all cases the chiropractor obtain the patient's history to locate the disease process. Following this a spinal analysis is to be made. The path of the associated nerve is then to be traced from the intervertebral foramen to the periphery, or in the reverse direction. No preference is established, according to the teaching of this method, as "error may occur in either case due to the fact that the vertebra may not be subluxated or the organ may not exhibit tenderness."

Briefly stated, the technique of nerve tracing generally taught is as follows: The patient should be seated. Use either hand and palpate with the tip of the middle finger, braced with the thumb and forefinger, with the other fingers flexed in the palm of the hand. The patient's body surface should be exposed. The palpator may take any position that is convenient. Start at the exit of the nerve, or at the periphery, and make pressure over the supposed point of tenderness. If no tenderness is found move the finger at right angle to the nerve, and if still no tenderness is elicited move the finger to a second point of contact slightly above. If this second point of contact gives no tenderness change to a point below the first. When a tender point is found move the finger one-half inch from the first tender point, along the supposed course of the nerve. If no tenderness is found at this second point extend the area until tenderness is found. Proceed until the nerve has been traced

from the center to the periphery. Where nerves pass beneath osseous structures pick them upon the other side. Instruct the patient to concentrate his attention on the sensation produced by pressure and to tell the palpator of any difference in feeling. If the patient notes a difference as the palpator makes pressure at various points along the supposed path of the nerves, it is an indication that the palpator has left the original pathway and is making pressure on another nerve. He should change his area until he again finds the first nerve and then complete his palpation. When finished with the first nerve he should go back to the point where the different sensation was located and trace this second nerve to its origin and termination.

From the foregoing, it is apparent that nerve tracing is not an infallible guide, either to the existence of a subluxation or to the presence of organic disease. The difficulties enumerated indicate that the method is restricted within rather narrow bounds. The principle upon which it is founded is, however, entirely correct within these limits.

In all abnormal states of the viscera there is present hyperaesthesia of the cutaneous area overlying the organ, and tenderness over the point at which the nerve emerges from the intervertebral foramen. It may be possible to also elicit tenderness along the spinal nerve between these two points. Inability to elicit tenderness on pressure between these points does not, however, indicate that there is no impingement at the intervertebral foramen and no disease in the organ which derives its nerve supply in part from the corresponding segment.

For all practical purposes, therefore, the elicitation of cutaneous hyperaesthesia over the organ and segmental tenderness over the nerve root is of greater diagnostic value than the tracing of a tender nerve path. It is by no means unusual to find tenderness of a nerve path, even when there is no disease of an organ. For example, tenderness of the thoracic nerves may often be traced along their entire course when there is no disease of the heart, lungs or pleura; tenderness of the lumbar nerves along their

entire pathway is frequently elicited when there is no disease of the pelvic organs. The tenderness in those cases may be due to intercostal or lumbo-abdominal neuralgia, and it is a fact that pleurodynia is frequently interpreted as pleurisy and lumbago as nephritis. It is plain, therefore, that tracing a tender nerve pathway may frequently be misleading. Even though the vertebra may be subluxated and tenderness of the nerve be present, disease of the organ which derives its nerve supply from that segment may not be present. The organ may be predisposed to disease, but in the absence of a contributing factor no disease has developed.

If, however, one can elicit cutaneous hyperaesthesia over the area overlying an organ and tenderness in the segment from which this organ derives its innervation, it may be definitely stated that disease of the organ exists. Cutaneous hyperaesthesia is found by picking up the skin between the thumb and forefinger at various points within the area overlying the organ that is supposed to be affected. Spinal tenderness is ascertained by manipulation over the organs presumed to be affected for a minute or two, following which pressure elicits tenderness over the nerve roots that was not demonstrable previous to such manipulation over the organ. The presence of positive findings of this kind justify the assumption that the organ in question is diseased.

It must be emphasized that in any event the tracing of the nerve is confined to the tract of the cutaneous branch of the nerve root from which the branches in direct contact with the internal viscera are derived. In no case can it be assumed that the tender nerves which are traced by this method are the ones directly connected with the organ. The spinal and autonomic nerves are derived from the same segment, the former supplying skin, ligaments and muscles, while the latter supply the internal viscera. The tenderness elicited in nerve tracing is therefore confined strictly to the superficial branches of the nerve roots emanating from a certain segment of the cord. The difficulties in connection with nerve tracing enumerated above verify this, inasmuch as they attest to the impossibility of tracing the cranial and

autonomic nerves. Obviously this leaves only the spinal nerve.

The contention that nerve tracing is confined to the cutaneous branches of the nerve root from each segment is further borne out by the fact that the viscera are known to be poorly endowed with sensory nerves. Pain and tenderness referred to an organ by the sensorium are actually present in the cutaneous nerves derived from the same segment that emanate the autonomic nerves, which are in actual relationship to the organ. It is well known that the kidney could be cut in half without causing anything approaching severe pain. In a stab wound of the chest the pain experienced by the subject is actually limited to the thoracic wall and pleura, the wound in the lungs itself exciting very little pain sensation. When a trocar is inserted into the abdomen in dropsy its passage through the abdominal wall excites pain sensation, but its movement within the abdomen causes little or no pain sensation. These and other illustrations that might be cited show that the viscera are poorly supplied with sensory nerves and that the tenderness elicited on nerve tracing is actually confined to the cutaneous nerves that emanate from the segment that controls the diseased organs.

The chiropractor must, therefore, entertain the notion that when he is palpating a tender nerve he is palpating the nerve that directly supplies the organ innervated from the segment that gives rise to such a tender nerve. It is the autonomic nerves which directly supply the organs. These nerves register sensation very slowly and it is for that reason that associated cutaneous sensory nerves exist, so that the central axis may be more quickly acquainted with changing conditions affecting all parts of the periphery.

From the foregoing, it is apparent that spinal tenderness and cutaneous hyperaesthesia are a valuable assistance in diagnosis. This method, together with the spinal analysis establishes with almost unfailing certainty the location of a disease process. The clinical history, general and special examination of the patient, together with other diagnostic methods will enable the attendant to make an accurate diagnosis in virtually all his cases.

SECTION SIX

Spinal Adjustment

CHAPTER I

General Considerations

Briefly defined, spinal adjustment is the replacement to their normal position of subluxated vertebrae for the purpose of relieving impingement of the structures transmitted by the intervertebral foramen, and thus restoring to the parts supplied by these nerves their normal quota of innervation.

This replacement of subluxated vertebrae is accomplished by the application of a definite thrust by the hands of the operator in contact with the subluxated vertebra.

When a thrust is applied to a displaced vertebra the amount of movement of the vertebra varies considerably and is in direct ratio to the length of time that the displacement has existed. In a recent subluxation, one that has existed for one or two days only, the adjustment is completed by one thrust in many cases. When, however, a vertebra has been subluxated for a number of years its adjustment often becomes a matter of many months for the reason that each thrust applied to the vertebra rehabilitates the discs and ligaments so slightly that the change in position of the vertebra is practically imperceptible.

Spinal adjustment must not be considered as the pushing of a vertebra back to its proper position, as that is not the primary effect of the thrust which is applied to the vertebra. The immediate effect of the thrust upon the vertebra is a momentary relaxation of the ligaments of one side permitting the ligaments of the opposite side which had been stretched beyond the limit of their elasticity to return to their original condition. When the adjustment is made a sound, very much like that produced by "cracking" the

knuckles of the fingers, is heard. This is produced by the sudden filling in of the vacuum created by the momentary separation of the vertebrae.

To overcome the contraction of the ligaments which are drawing the displaced vertebra out of alignment the thrust must be spontaneous, and be applied at the moment of most complete relaxation of the patient. A slow, continous pressure, regardless of how heavy it might be, will not accomplish the desired effect; on the contrary, it will tend to aggravate the contraction of the ligaments. A familiar example at this point will serve to make clear this important phase of spinal adjustment. We are all familiar with the cramp of the plantar muscles, and have observed how this cramp draws the bones of the foot in various directions. A sudden blow upon the contracted muscles brings instant relief by causing the muscles to relax, which permits the bones of the foot to return to their normal position. This is exactly what occurs in the vertebral column; a certain ligament is contracted and draws the vertebra with which it is connected out of alignment; the spontaneity of the thrust causes the contracted ligament to become relaxed, and the vertebra returns to its normal position.

The first prerequisite to successful spinal adjustment, therefore, is that the thrust be spontaneous. This spontaniety is well illustrated by the sharp, quick blow of a hammer upon a hard surface like an anvil. The rebound of the hammer is caused by the rapidity of the stroke rather than by the strength or continuity of the force applied. Another and still better illustration may be given by taking a pile of individual blocks. A sharp, quick blow against one of the blocks will move the individual block against which the stroke is directed without affecting the pile as a whole, whereas steady pressure lacking the spontaneity referred to, would simply push over the entire column or pile of blocks.

In the application of the thrust no great expenditure of force is required. William Jay Dana, B. S., says in respect to this that, "it can be easily shown mathematically that if a spine can stand a tension of 750 pounds, it would only take a blow with a velocity of five feet a second, given

by a man who could put ten pounds of his weight behind his adjustment, in order to move a vertebra one-sixteenth of an inch. This kind of a blow is obviously within the capacity of any average man."

How replacement of the vertebra occurs is also very accurately explained by Dana, as follows: Mechanical shearing occurs when two equal and opposite forces act at right angles to a bar. When tension is transmitted through two overlapping boiler plates riveted together, the first effect is a sidewise compression on the rivets, tending to cut them off. To move one vertebra with respect to another, shearing forces must be used. The intervertebral cartilaginous disc must be sheared to produce an actual molecular displacement or separation. The high speed adjustment accomplishes this, separating the vertebrae, and relieving the pressure at the foramina. An adjustment causes a slight injury; hence an increased metabolism of the surrounding tissues; the blood is rushed to the tissues for reparative purposes, compressed cartilages are built up, thereby relieving the pressure exerted by the previously approximated vertebrae."

To obtain the greatest degree of spontaneity in giving the thrust several things must be observed.

The first of these relates to the manner of delivering the thrust. On having determined the exact nature of the subluxation, the operator places the proper contact point of the hand on the desired point of the vertebra to be adjusted. A firm degree of pressure should exist at the contact point, and should not be increased or diminished during the delivery of the thrust. The operator should stand near to and directly over the patient so that the arms are perfectly perpendicular to the patient's back. The arms should be held rigid, with the elbows locked. The shoulders are then raised to the greatest degree consistent with the maintenance of the desired pressure on the spine at the contact points. The thrust is then delivered by a quick downward movement of the shoulders, arms and back, with the hip-joint as an axis. As soon as the thrust has been made the hands should be removed from the back. The thrust should be made as soon as the correct contact with the vertebra

to be adjusted has been applied, since any delay in executing the thrust permits contraction of the spinal musculature from apprehension on the part of the patient. The precise direction of the movement is governed by the nature of the subluxation and the region of the spine in which it is located.

The second essential to the proper delivery of the thrust relates to the operator's position. The object and importance of a correct position for the delivery of the thrust should be constantly borne in mind. Unless perfect poise is secured and maintained, the operator will not be able to accumulate the force necessary to deliver the thrust at the right time and in the right direction. The prime essential to the success of the thrust, namely that it be spontaneous, can only be secured when the operator is perfectly poised. This poise enables him to be in a state of readiness to take advantage of the momentary relaxation of the patient, which is most apparent at the end of expiration. It also enables the operator to feign a thrust in a very sensitive or hysterical patient. This is done by pressing down on the patient's back, and making a short, mild thrust, followed by one of greater force at the moment of relaxation on the part of the patient from the first thrust. It also permits of delivery of the thrust at the proper angle. The poise should be such as will enable the force to be carried downward equally along each arm to the point of contact, when a double contact is employed. When a single contact is used, the force is carried along the arm which applies the thrust, and in the direction which is necessary for the correction of the subluxation. Lastly the proper poise is of importance since it permits the thrust to be given without the slightest discomfort to the patient, and with the greatest ease to the operator.

The third requisite to the successful delivery of the thrust is that it be applied at the moment of extreme relaxation of the patient. It will be found in this connection that the best rule to follow will be to deliver the thrust as soon as the proper contact with the vertebra to be adjusted has been made, and before any contraction of the muscles of the patient's back, due to apprehension on his part, has

had time to develop. This is best accomplished by "timing" the entire procedure in respect to the two phases of the respiratory act. During inhalation the proper contact is obtained so that the thrust can be made immediately thereafter, during exhalation. If, however, the patient continuously contracts the muscles, a feint thrust, immediately followed by one of greater force, should be given, since after the milder thrust there occurs a period of momentary relaxation. If even this is unsuccessful, the operator should wait until the patient is breathing naturally, and then apply the thrust at the point of extreme exhalation. One of these methods will enable the thrust to be successfully delivered. In any event, however, it is advisable to instruct the patient in regard to the necessity of perfect relaxation on his part, and this may be acquired by his own volition. If an adjustment is made in spite of the fact that the patient is not completely relaxed, considerable soreness at the point over which the thrust is made may be experienced for some time. Every means should therefore be employed to secure perfect relaxation of the patient before the thrust is applied, and one of the above methods will always suffice to produce this.

Equal in importance with the manner of delivering the thrust is the mode of contact of the operator's hand with the vertebra to be adjusted, which in chiropractic terminology is known as the "Hold." The reader will note in future chapters that these holds are not all in direct connection with the vertebral column. It may be said, however, that whenever a specific vertebra is to be adjusted, the hands should be in contact with the vertebra itself. In the giving of the thrust the spinous, transverse or articular processes are used as levers, while the force which acts through these levers to produce a movement of the vertebra as a whole is applied by the contact hand. There are in vogue among chiropractors a great variety of holds, since nearly every operator favors, some particular form of contact which he uses almost exclusively in all regions of the spine, with slight variations. There thus appear in this work holds which are highly endorsed by some and which are equally condemned by other chiropractors. However,

Fig. 59
Showing the Contact Points
On the Hand.

it is our opinion that not one of the holds mentioned is entirely devoid of some merit. In general the operator will find that a few holds will suffice; there are, however, cases in which none of the commonly used holds will serve to produce the desired effect, and it becomes necessary to use a hold which, though it is seldom resorted to, still has a place in just this class of cases. In the descriptions of the various holds those having the greatest range of usefulness are therefore placed first; if it is found, as occasionally happens, that one of these holds will not produce the adjustment, one of the others should be employed.

In the great majority of cases it will be found that contact with the transverse processes is much to be preferred to that with the spinous processes. The reasons for this are obvious to any one who uses both methods for a time, and compares the effects of each. Chief among the reasons why the use of the transverse processes as levers is preferable is the fact that the force can be directed with greater accuracy. Some chiropractors disregard the transverse processes entirely, even in palpation, and therefore also in adjustment, and limit themselves to the spinous processes exclusively. From what has been said in preceding chapters the reader must appreciate that such methods must fail in some instances. Another important reason for using the transverse processes rather than the spinous wherever possible is that by using the former as levers the possibility of producing soreness due to bruising of the skin or periostitis, following the adjustment is greatly minimized. Assistance of Dr. A. K. Golden is here acknowledged.

The final essential to the proper delivery of the thrust is the point of contact of the operator's hand. Fig. 59. illustrates these points which are named as follows:

1. The Calcanear contact.
2. The Pisiform contact.
3. The Hypothenar contact.
4. The Thenar contact.
5. The Thumb contact.
6. The Digital contact.

The indications for the use of each of these various forms of contact are given under the various holds described in the following chapters.

CHAPTER II

Adjustment of the Cervical Vertebrae

The Temporo-Articular Hold.—Indications.—This hold is the best for general use in the cervical region. It lacks entirely the element of harshness present in other holds used for adjustment of the vertebrae in this region. It is especially adapted to correction of lateral, rotary, scoliotic, and right or left inferior subluxations. It is often referred to as the "Rotary" or the "Break."

Position of the patient.—The patient should be in the dorsal position.

Points of contact.—The head of the patient rests in one hand of the operator, while the thenar eminence of the other hand is placed against the articular process. In right or left posterior subluxations the contact is with the posterior surface of the articular process which is posterior; in lateral subluxations the contact is on the union of the transverse and costal processes which are displaced away from the line of the spinous processes; in right or left inferior subluxations the contact is with the inferior surface of the articular process of the side of the vertebra which is displaced downward; in scoliosis each vertebra should be separately adjusted. The thumb of the hand in contact with the vertebra should be supported on the side of the patient's lower jaw.

Method of delivery.—The head is raised, with the patient's face turned away from the contact hand, and flexed in the direction of the hand in contact with the vertebra to be adjusted. When completely flexed, a spontaneous thrust is made against the articular process at the same time that the head is brought in the direction of the contact hand. The direction of the thrust depends upon the nature of the subluxation, namely in the direction that will place the vertebra in proper alignment.

This hold is illustrated in Figs. 60 and 61.

Fig. 60
Temporo-Articular Hold

Fig. 61
Temporo-Articular Hold

Fig. 62
Bilateral Pisiform-Transverse
Anterior Hold.

The Bilateral Pisiform-Transverse Anterior Hold.—Indications.—Anterior subluxations of the cervical vertebrae.

Position of patient.—The patient is in the dorsal position.

Points of contact.—The pisiform processes are placed on the anterior surface of the transverse processes of the subluxated vertebra. Great care must be exercised in applying this hold that the vessels of the neck are pushed forward and not compressed between the hands and the transverse processes.

Method of delivery.—The movement is straight posteriorly, and the force is conveyed equally through both arms spontaneously and with a downward movement of the shoulders. Care should be taken not to permit the hands to slip when the thrust is being delivered.

This hold is illustrated in Fig. 62.

The T. M. or Thumb Movement Hold.—Indications.—This hold is very useful in correcting right and left posterior and lateral subluxations in the lower cervical region, and may be used in that region when the operator is unable to obtain a perfect contact with the vertebra to be adjusted by the temporo-transverse hold.

This hold is fully described and illustrated under adjustment of the thoracic vertebrae, q. v.

The Unilateral Pisiform-Transverse Anterior Hold.—Indications.—In some instances when the cervical vertebrae, and especially the atlas, are displaced anteriorly on one side, in other words rotated, it rarely becomes necessary to use this hold.

Position of the patient.—The patient should be in the dorsal position.

Points of contact.—The pisiform process of one hand is placed in contact with the anterior surfaces of the transverse process which is displaced forward; the other hand grasps the wrist of the contact hand. In order to facilitate the obtaining of the proper contact the patient's face is turned away from the contact point on the vertebra to be adjusted.

Method of delivery.—The thrust is directed backward. This relieves the contraction of the ligaments on this side

Fig. 63
Unilateral Pisiform-Transverse Hold.

and permits the vertebra to return to its proper position. It must be remembered in this connection that when a vertebra is rotated upon its axis it may be due to a contraction of the ligaments of one side drawing the corresponding side of the vertebra backward; or it may be a contraction of the ligaments on the other side which draws that side of the vertebra forward. In either case the vertebra is rotated in exactly the same direction, and only the contraction of the ligaments will serve to distinguish between them. In the latter form this hold is therefore necessary. This hold is illustrated in Fig. 63.

The Digito-Articular Hold.—Indications.—This hold is used exclusively for adjustment of the cervical vertebrae on any patient but found invaluable with patients who cannot lie in the dorsal position. It is used in adjusting any form of subluxations found in the cervical region.

Positions of patient and adjustor.—The patient is in the sitting position with the hands in the lap, on the extreme lower end of the table or better on a stool. The adjustor stands behind the patient while palpating for subluxations and to the side of the patient opposite the point of contact while giving the adjustment. For example, if the contact is made on the right side, stand on the left side of the patient.

Points of Contact.—When the contact is to be made on the right side, adjustor stands slightly to left and back of patient, bringing the left arm under the chin of the patient, getting a firm but gentle contact on the articular process with the ball of the middle finger of the left hand; allow chin of patient to lie in the palm of his left hand; place palm of the right hand above the left ear of the patient with fingers extended above patient's brow; turn patient's face half around toward adjustor and with right hand make pressure away from adjustor until all slack is taken up; then simultaneously give thrust with the ball of the middle finger toward the adjustor, using the middle finger of the left hand as a hook. If contact is to be made on the left side, reverse the above.

This hold is illustrated in Fig. 64.

The Occipito-Mandibular Hold A.—Indications.—This hold is useful in relieving an approximated condition of the occipital condyles and the superior articular processes of the atlas, a form of inferior subluxation.

Position of the patient.—In this hold the patient is prone. The operator stands at the patient's head.

Points of contact.—The patient's face is turned to the side. The operator grasps the lower jaw with one hand, and the occiput with the other hand.

Method of delivery.—The neck is extended as much as possible. At the same time the head is rotated to the greatest possible extent. The tension is then momentarily released, and at the same instant a spontaneous movement is made. For relieving the same condition on the opposite side, the movement and hold are reversed.

This hold is illustrated in Fig. 65.

The Occipito-Mandibular Hold B.—Indications.—Same as above.

Position of the patient.—The patient's body is prone, while the head is turned markedly. The operator stands at the head of the patient.

Points of contact.—One hand grasps the lower jaw, and the other hand the occiput.

Method of delivery.—Extension of the neck is made at the same time that the head is rotated. This is followed by a momentary release of the tension thus produced, and immediately thereupon a spontaneous movement of the hands is made.

This hold is illustrated in Fig. 66.

The Occipito-Mandibular Hold C.—Indications.—Same as above. This hold is of advantage in that it requires no equipment of any kind, and often produces results not otherwise obtained.

Position of the patient.—The patient is in the erect position and seated. The operator stands to one side of the patient.

Points of contact.—One hand is placed firmly under the patient's lower jaw, while the other grasps the occiput.

Method of delivery.—Upward traction is made with both hands for the purpose of stretching the muscles of this

Fig. 64
Digito-Articular Hold.

Fig. 65
Occipito-Mandibular Hold A.

Fig. 66
Occipito-Mandibular Hold B.

Fig. 67
Occipito-Mandibular Hold C.

region. The head is then turned toward one side. When the rotation of the head is complete, the tension is slightly released and immediately thereafter a spontaneous movement is made. For correcting a like condition on the opposite side the hold is reversed.

The Malar-Articular Hold.—Indications.—This is a method for correcting certain forms of right or left posterior subluxations of the cervical group which will occasionally serve the operator to good advantage.

Position of the patient.—The patient should be placed in the sitting position.

Points of contact.—The thumb is placed back of the articular process which is posterior, while the other hand is placed on the side of the patient's face over the malar bone; the operator stands almost directly behind the patient.

Method of delivery.—The face of the patient is turned toward the subluxated side. A simultaneous thrust is made with the two hands toward each other. The same hold may be employed with the patient in the prone position.

This hold is illustrated in Figs. 68 and 69.

The Fronto-Articular Hold.—Indications.—This is an excellent movement in certain cases of compression of the discs between the cervical vertebrae.

Position of the patient.—The patient is in the dorsal position.

Points of contact.—One hand is placed on the patient's forehead and the other just posterior to the articular processes; the four fingers are used, each being placed on the articular process of a single vertebra as shown in Fig. 70.

Method of delivery.—In making the movement, the hand on the forehead is held firm and steady, while that in contact with the posterior surface of the articular processes is drawn up toward the operator; at each such movement a different finger is employed. For example, if the index finger is in contact with the posterior surface of the articular process of the third cervical, the first movement is made at this point; the next movement is made in the same manner with the second finger in contact with the posterior surface of the articular process of the fourth cervical vertebra; the third movement is the same with the third finger

Fig. 68
Malar-Articular Hold

Fig. 69
Malar-Articular Hold

Fig. 70
Fronto-Articular Hold

Fig. 71
Parieto-Articular Hold.

in contact in the same manner with the fifth vertebra; and the fourth movement with the finger in contact with the sixth vertebra. Repeat the movements in the same order several times. Then rotate the head as shown in Fig. 71, which illustrates the Parieto-Articular hold. Repeat the movements with the hands in the position of the Parieto-Articular hold, finishing with an exaggerated lateral flexion with the finger of the articular process of the subluxated vertebra. This should be executed in the same spontaneous manner as previously described.

This hold is illustrated in Figs. 70 and 71.

CHAPTER III

Adjustment of the Thoracic Vertebrae

The Thumb-Transverse Hold.—Indications.—This hold is principally used for adjustment of the upper thoracic vertebrae in delicate patients, women, and children up to the age of eight or ten years. In young children it is a convenient hold for the entire thoracic and lumbar regions. It is used in the correction of posterior, inferior, right or left inferior and right or left posterior subluxations.

Position of the patient.—The patient is in the prone position. The two sections of the table should be separated, and care should be taken to see that the chest rests on the chest-support of the table. The operator stands on the side of the table which is most convenient for him in delivering the thrust. When it is not convenient to place a very young child upon the table, the following methods may be employed: The child should be taken in the arms of the operator so that its chest presses against his chest; after the nature of the subluxation has been determined, a thrust is made with the middle finger in contact with the transverse processes of the vertebra to be adjusted. The child may be placed in the prone position, across the mother's or the adjustor's knees. In either case the limbs should be held apart. Whenever possible, however, the table should be used, and the thumb-transverse hold employed.

Points of contact.—The balls of the thumbs are placed on the transverse processes, being supported by the first and second phalanges of the index finger, which, in very young children rests on the angle of the ribs.

Method of delivery.—The contact having been obtained, a spontaneous thrust is made. This will vary according to the nature of the subluxation. In a posterior subluxation the force is directed downward equally along each arm; in inferior subluxations the contact is on the inferior surface of the transverse processes, and the force directed toward

Fig. 72
Thumb-Transverse Hold.

Fig. 73
Crossed Thumb-Transverse Hold.

Fig. 74
Crossed Bilateral Pisiform-Transverse Hold.

Fig. 75
Pisiform-Spinous Hold

the head; in a right or left inferior subluxation the thumb is placed on the inferior surface of the transverse process of that side of the vertebra which is displaced downward, and the force directed toward the head; when in a right or left inferior subluxation the ligamentous contraction is drawing one side of a vertebra upward, the thumb should be placed upon the superior surface of the transverse process which is misplaced superiorly, and the thrust directed toward the sacrum; in a right or left posterior subluxation the greater force is directed along the arm which is in contact with the posteriorly displaced transverse process.

This hold is illustrated in Fig. 72.

The Crossed Thumb-Transverse Hold.—Indications.—These are the same as those for the hold described above.

Position of the patient.—The patient is in the prone position, with the sections of the table separated, and the operator standing at either side.

Points of contact.—The thumbs instead of being applied on the transverse processes of the corresponding sides are crossed.

Method of delivery.—This is the same as that described under the Thumb-Transverse hold.

This hold is illustrated in Fig. 73.

The Crossed Bilateral Pisiform-Transverse Hold.—Indications.—This is the best hold for correction of subluxations of the upper eight thoracic vertebrae. It is adapted to the correction of posterior, inferior, right or left inferior, and right or left posterior subluxations.

Position of the patient.—The patient is in the prone position.

Points of contact.—The pisiform process of the operator's right hand is placed upon the left transverse process of the vertebra to be adjusted; the pisiform process of the operator's left hand is placed on the transverse process of the right side.

Method of delivery.—The operator should stand at the side of the patient and near him, with the center of his body opposite the point of contact with the vertebra to be adjusted. This position will obviate the possibility of the crossed wrists interfering with each other. Care must also

be exercised to secure the proper poise before making the thrust with this hold, as otherwise the force of the thrust will not be properly delivered. The arms should be perpendicular to the back of the patient, and the elbows rigid. The application and direction of the force will depend upon the nature of the subluxation which is being adjusted. In a posterior subluxation the force is directed downward equally along each arm to the contact points. In an inferior subluxation in which a vertebra is approximated toward the one below it, the contact is with the inferior surface of the transverse processes and the force of the thrust is directed toward the head. In cases of right or left inferior subluxations the same rules apply as for inferior subluxations except that the thrust is directed against only one transverse process. In a right or left posterior subluxation the force is directed downward upon the transverse process which is posteriorly displaced. In a postero-inferior subluxation the force of the thrust is directed upward and equally through both arms.

This hold is illustrated in Fig. 74.

The Bilateral Pisiform-Transverse Hold.—Indications.—This is a very useful hold, and is best adapted to correction of subluxations from the eighth to the twelfth thoracic, and in all the lumbar vertebrae. In some cases it may be used in the entire thoracic region; this will, however, depend upon the conformity of the patient's back and the operator's ability to acquire the hold. A milder movement may be made with this hold than with the same hold with the hands crossed. When a very mild adjustment is desired, there is no better hold than this, as spontaneity can be obtained without the peculiar shock characteristic of some of the other holds where rigidity of the arms is an essential factor to a successful delivery. This hold is used in correcting posterior, kyphotic, inferior, and right or left posterior subluxations.

Position of the patient.—The patient should be in the prone position, with the sections of the table separated and the front section lowered.

Points of contact.—By the term pisiform-transverse hold it is not meant to be understood that the pisiform

Fig. 76
Unilateral Pisiform-Transverse Hold.

Fig. 77
Ulno-Spinous Hold.

processes are placed directly on the transverse processes; on the contrary, they are placed immediately in front, behind, or to the side, as is made necessary by the nature of the subluxation. The right hand is placed on the transverse process of the right side, while the left hand is in contact with the left transverse process. When a vertebra is displaced posteriorly the contact is directly on the transverse processes. When the subluxation is right or left posterior, the contact is similar, but the greater force is directed toward the transverse process which is posteriorly displaced. In an inferior subluxation the contact is with the inferior surface of the transverse processes.

Method of delivery.—The proper contact, as above indicated, having been secured, a spontaneous movement from the forearms, and an upward turn of the wrist should be made. The direction of the force is determined by the nature of the subluxation. In a posterior or kyphotic subluxation, it is directed downard. When a right or left posterior subluxation is present the force is directed principally along one arm, namely that in contact with the posteriorly displaced tranverse process. In an inferior subluxation the thrust is directed toward the head.

This hold is illustrated in the chapter on the adjustment of the lumbar vertebrae.

The Pisiform-Spinous Hold.—Indications.—This hold is used principally for the correction of kyphotic subluxations, and in some forms of lumbar subluxations in certain cases. This hold may, however, be used for the correction of any form of subluxation, but will prove to be more severe and disagreeable to the patient than other holds here suggested, and its use should therefore be limited to the indications above mentioned.

Position of the patient.—The patient should be in the prone position; the operator stands to either side as necessary.

Points of contact.—The pisiform process of one hand is placed upon the spinous process of the vertebra to be adjusted; the other hand grasps the wrist of the contact hand.

Method of delivery.—In giving the thrust the arm which grasps the wrist of the contact hand should be held rigid

with the eblow flexed and firm pressure applied at the contact point. A peculiar swing of the shoulders is then made and the force directed in the proper direction.

This hold is illustrated in Fig. 75.

The Unilateral Pisiform-Transverse Hold.—Indications.—Right or left posterior, lateral, and right or left inferior subluxations in the dorsal region of the spine.

Position of the patient.—The patient should be in the prone position. The two sections of the table should be separated, and the front section depressed.

Points of contact.—The pisiform process is placed directly upon the transverse process which is posterior in right or left posterior subluxations. In right or left inferior subluxations in which the contraction of the ligaments is on one side which is drawn upward the contact should be on that side and upon the superior surface of the transverse process; when the contraction of the ligaments is such as to draw the vertebra downward on one side the contact should be with the inferior surface of the transverse process which is inferiorly displaced.

Method of delivery.—The contact having been obtained, the force of the thrust is directed principally through the contact hand, and in that direction necessary to the proper replacement of the subluxated vertebra. The points of contact will indicate the direction in which the force should be delivered.

This hold is illustrated in Fig. 76.

The Ulno-Spinous Hold.—Indications.—The indications, position of the patient, and method of delivery when this hold is used are the same as those of the pisiform-spinous hold. The only difference is in the mode of contact, which in this hold is made with the ulnar border of the hand upon the spinous process; this becomes necessary in individuals who are very sensitive.

This hold is illustrated in Fig. 77.

The Angular Pisiform-Transverse Hold.—Indications.—This hold is employed for the correction of right or left posterior, right or left inferior and lateral misplacements.

Position of the patient.—The patient is in the prone position.

Fig. 78
Angular-Pisiform-Transverse Hold.

Fig. 79
Bilateral Digito-Transverse Hold.

Points of contact.—One hand is placed perpendicularly to the long axis of the spine, with the pisiform process on the transverse process which is posteriorly displaced in a right or left posterior subluxation, or in a lateral subluxation, on the side toward which the vertebra is displaced. The other hand is placed horizontally to the long axis of the spine, with the pisiform process in contact with the transverse process of the other side.

Method of delivery.—The manner of delivery of the thrust is the same as that described in the preceding holds. The principal force is, however, directed to the hand in contact with the spine which is placed parallel with the long axis of the spine. A small portion of the force is directed to the other hand, which is applied principally as a guard against slipping of the tissues, and as a gauge in the delivery of the thrust. In a right or left posterior subluxation the force is directed downward; in a lateral subluxation it is directed downward and toward the side from which the vertebra is displaced; in a right or left inferior subluxation the force is directed upward on the inferior transverse process and downward on the superior transverse process.

This hold is illustrated in Fig. 78.

The Bilateral Digito-Transverse Hold.—Indications.—Posterior and right or left posterior subluxations from the fourth to the ninth thoracic vertebrae.

Position of the patient.—The patient should be in the prone position.

Points of contact.—The index and middle finger of the contact hand are placed upon the transverse process of one side of the vertebra to be adjusted; the ring and little finger are placed upon the tranverse process of the other side. The other hand is placed on the dorsal surface of the contact hand to assist in giving the proper force to the thrust.

Method of delivery.—In a posterior subluxation the force is directed upon both transverse processes equally, with the characteristic spontaneous thrust. In a right or left posterior subluxation the greater force is directed toward one side, namely upon the transverse process which is posteriorly displaced.

This hold is illustrated in Fig. 79.

The T. M. Hold.—Indications.—This hold is useful in adjustment of the upper three or four dorsal vertebrae, in addition to the lower cervical. It is adapted to correction of lateral and right or left posterior subluxations.

Position of the patient.—The patient is in the erect position and seated. The operator stands behind the patient, or slightly to one side.

Points of contact.—The thumb of one hand is placed against the side of the spinous process while the hand as a whole is supported by resting the fingers upon the patient's shoulder; the thumb is placed on that side of the spinous process toward which the vertebra is displaced. The other hand is placed against the side of the patient's face and head, and the elbow may rest on the patient's shoulder on that side.

Method of delivery.—The patient's head is flexed toward the contact point to the farthest extent, and a simultaneous thrust made with both hands toward each other. Care must be exercised to prevent slipping of the thumb at the moment the thrust is made against the side of the spinous process.

This hold is illustrated in Fig. 80.

The Mandibulo-Spinous Hold.—Indications.—Right or left superior subluxations in the upper thoracic region.

Position of the patient.—The patient is in the erect position and seated.

Points of contact.—The contact of the hand with the vertebra to be adjusted is the same in this hold as it is in the T. M. hold, namely, with the thumb placed against the side of the spinous process toward which the vertebra is rotated, with the fingers placed on the shoulder of the patient. The other hand grasps the patient's chin.

Method of delivery.—The patient's face is turned away from the side on which the contact hand is placed. When the limit of rotation of the head has been reached, a thrust is given with both hands at the same time, the direction of the force being applied toward each other.

This hold is illustrated in Fig. 81.

Fig. 80
T. M. Hold.

Fig. 81
Mandibulo-Spinous Hold.

Fig. 82
Calcaneo-Spinous Hold.

Fig. 83
Sacro-Spinous Hold.

Fig. 84
Thoracic Extension Hold I.

Fig. 85
Thoracic Extension Hold II.

The Calcaneo-Spinous Hold.—Indications.—This hold is adapted to correction of posterior, inferior and antero-inferior subluxations in the thoracic and lumbar regions.

Position of the patient.—The patient shoud be in the prone position.

Points of contact.—In a posterior subluxation the groove between the pisiform bone and the base of the thumb is placed directly upon the tip of the spinous process. In an adjustment of inferior subluxation the contact of the heel of the hand is with the under surface of the spinous process; in an antero-inferior subluxation the heel of the hand is in contact with the upper surface of the spinous process. The wrist of the contact hand is grasped by the other hand.

Method of delivery.—The fingers of the contact hand extend along the patient's spine, and the arm of the contact hand is perfectly straight and rigid. In a posterior subluxation the force of the thrust is directed directly downward perpendicularly to the patient's back. In an antero-inferior subluxation the force of the thrust is directed toward the sacrum. When the vertebra is displaced downward, the force of the thrust is directed toward the head of the patient.

This hold is illustrated in Fig. 82.

The Sacro-Spinous Hold.—Indications.—This is not a specific method of adjustment, but may be used for the purpose of causing extension of the vertebral column, and may be used to advantage especially in lordosis of a section of the spine.

Position of the patient.—The patient should be in the prone position, with the front section of the table depressed.

Points of contact.—One hand is placed on the sacrum, while the other is in contact with the spinous processes, both hands being parallel with the long axis of the spine, and the arms crossed.

Method of delivery.—No specific thrust is given. The hands press upon the sacrum and spinous process simultaneously, very forcibly and steadily, in this way obtaining a considerable extension of the spine.

This hold is illustrated in Fig. 83.

The Thoracic Extension Hold I.—Indications.—This is not a specific method of adjustment, and is used for opening the thoracic articulations and relieving contractured conditions of the vertebral ligaments. In what is commonly known as "backache" and which is simply a settling of the vertebrae upon each other so that impingement of the nerves is produced, application of this hold gives great relief.

Position of the patient.—The patient should stand erect and reclining slightly backward, with the hands folded and placed behind the head, which is thrown a little forward. The operator stands behind the patient facing the latter's back.

Points of contact.—The operator passes his hands under the patient's arms and grasps the wrists.

Method of delivery.—The patient is lifted suddenly from the floor and at the same time a quick upward jerk is given the body.

This hold is illustrated in Fig. 84.

The Thoracic Extension Hold II.—Indications.—The indications for this movement are the same as those for the preceding. In some instances it is preferable.

Position of the patient.—The patient is erect, with the elbows flexed and brought together, while the hands are placed on either side of the face.

Points of contact.—The operator stands directly behind the patient, with the latter's elbows in the hollow of his hands.

Method of delivery.—The patient is suddenly lifted from the floor, and at the same instant a quick upward jerk is given the body.

The hold is illustrated in Fig. 85.

The "Recoil."—This hold is the exclusive method of adjustment used by some operators in all regions of the spine and for all forms of subluxation, the contact being upon the spinous process in every instance. The force of the thrust is directed in the direction in which the vertebra is to be replaced. The advantages claimed for this hold by its advo-

Fig. 86
The "Recoil" (Palmer).

cates and the disadvantages ascribed to it by its opponents practically outweigh each other in the opinion of the author. We make use of the spinous processes in many instances but feel that there are cases in which the use of the transverse processes of the subluxated vertebra as the levers is much to be preferred.

This hold is illustrated in Fig. 86.

CHAPTER IV

Adjustment of the Lumbar Vertebrae

The Bilateral Pisiform-Transverse Hold.—This hold will be found described fully in chapter three of this section, and is illustrated in Fig. 87.

The Ulno-Spinous Hold.—This hold is also described in the chapter dealing with the adjustment of the dorsal vertebrae.

Figure 88 illustrates this hold, which shows the force of the thrust directed downward toward the sacrum, while in the previous chapter the illustration of this hold shows the thrust being delivered toward the patient's head.

The Ilio-Spinous Hold.—Indications.—This is more in the nature of a passive movement than a specific thrust. It is, however, very useful in correcting scoliosis in both the lumbar and thoracic regions.

Position of the patient.—The patient is in the prone position; the table is closed, and both sections are at the same level.

Points of contact.—One hand of the operator grasps the anterior superior spine of the ilium, while the heel of the other hand is pressed firmly against the spinous processes on the side toward which the curve is directed.

Method of delivery.—The hand in contact with the spinous processes pushes them over to the opposite side to that in which the curve is directed, while at the same time the other hand draws up the patient's hip. This movement is repeated a number of times as made necessary by the degree of the scoliosis.

This hold is illustrated in Fig. 89.

The Thumb-Transverse Hold.—Indications.—This hold is adapted to correction of posterior, kyphotic, and right or left posterior subluxations in the lumbar region.

Fig. 87
Bilateral Pisiform-Transverse Hold

Fig. 88
Ulno-Spinous Hold.

Fig. 89
Illio-Spinous Hold.

Fig. 90
Supra-Sacral Hold.

For other points concerning this hold the reader is referred to the preceding chapter in which the methods of delivery and point of contact are fully described.

The Pisiform-Spinous Hold.—Indications.—This hold which is fully described in the preceding chapter is indicated in posterior, inferior, and right or left posterior suluxations of the lumbar region.

The Unilateral Pisiform-Transverse Hold.—This hold is described and illustrated in the preceding chapter. In the lumbar region it is indicated in right or left posterior and right or left inferior subluxations.

The Supra-Sacral Hold.—Indications.—This hold is used for the purpose of freeing the articulation between the fifth lumbar vertebra and the sacrum.

Position of the patient.—The patient is in the prone position. The front section of the table is lowered, thus elevating the sacral region.

Points of contact.—The right hand of the operator is placed upon the sacrum, and the wrist of the contact hand is grasped by the other hand.

Method of delivery.—The contact having been secured, a quick, spontaneous, downward thrust is made.

This hold is illustrated in Fig. 90.

The Genu-Transverse Hold.—Indications.—This hold is used only on the 4th and 5th Lumbars; more specifically, on the 5th lumbar. For the correction of posterior, antero-inferior, postero-inferior, right or left posterior and inferior subluxations.

Position of the Patient and Adjuster.—The patient is placed in the prone position. The abdominal section of the table opened, the lower end stationary. The adjustor stands on the left side of the table; the patient's knees flexed, the adjustor placing the right foot on the top of the end of the table with the knee of right leg against the patient's two tibia; the left foot of the adjustor firm on the floor and about opposite the tenth dorsal.

Points of Contact.—In correction of the 5th lumbar, the pisiform of the left hand is placed on the upper, outer and right portion of the sacrum, the pisiform of the right hand

on the left transverse process of the 4th lumbar. In cor rection of the 4th lumbar, the pisiform process of the left hand is placed on the right transverse process of the 4th lumbar and the pisiform of the right hand placed on the right transverse process of the 4th lumbar.

Method of Delivery.—When the contact of the hands is made in correcting the 5th lumbar, pressure is applied with the adjustor's knee against the tibia of the patient flexing the feet toward the patient's head as far as possible; then thrust simultaneously with left hand down and toward the knees and with the right hand down and toward the head of the patient. In correction of the 4th lumbar, the same position of the patient and adjustor as above, but the thrust should be made according to the kind of subluxation the same as in Crossed Bilateral Transverse Hold.

This hold is illustrated in Fig. 91.

The Genu-Spinous Hold.—Indications. — This hold is adapted to a correction of inferior or postero-inferior subluxations in the lumbar region, and is a counterpart of the Fronto-Transverse and Parieto-Transverse holds used in the cervical region. It is also used for correcting posterior, scoliotic, right or left inferior, and right or left posterior subluxations in the lumbar region, which it accomplishes by causing a relaxation of the ligaments.

Position of the patient.—The patient should be in the prone position, with the front section of the table slightly lowered.

Points of contact.—The heel of the contact hand is placed against the spinous processes of the vertebrae to be adjusted, while the other hand grasps the knee.

Method of delivery.—The leg is raised and drawn toward the operator, until the spine is markedly flexed. At the same time firm pressure is made against the spinous processes by the hand in contact therewith. A sudden thrust is then given with the contact hand and at the same time the leg is drawn upward. The direction of the thrust will depend upon the nature of the subluxation. In a posterior subluxation the force is directed downward. In a right or left posterior subluxation the contact is with the side of the spinous

Fig. 91
Flexed Genu-Transverse Hold.

Fig. 92
Genu-Spinous Hold.

Fig. 93
Ilio-Deltoid Hold.

Fig. 94
Genu-Deltoid Hold.

process toward which the vertebra is rotated, and the force of the thrust is applied in the opposite direction. In an inferior subluxation the force is directed downward, as well as in the right or left inferior subluxation, since this will relieve ligamentous contraction, and permit the vertebra to return into alignment.

This hold is illutsrated in Fig. 92.

The Ilio-Deltoid Hold.—Indications.—This hold is very useful in loosening up the lumbar and lower thoracic articulations. This is not a specific method for adjusting the vertebrae but it is followed by very good results in settling of this part of the spine and in lumbago.

Position of the patient.—The patient should lie on the side, with the arm which is next the table placed under the head.

Points of contact.—The operator should stand at one side of the patient and facing the subject. One hand is placed upon the posterior portion of the ilium, while the other hand grasps the anterior portion of the shoulder.

Method of delivery.—The contact having been obtained, the shoulder of the patient is pushed backward while the hip is drawn forward to the limit of normal motion. A simultaneous thrust of both hands is then made.

This hold is illustrated in Fig. 93.

The Genu-Deltoid Hold.—Indications.—These are the same as those for the preceding hold.

Position of the patient.—The patient's position is the same as above.

Points of contact.—One hand grasps the anterior portion of the shoulder, while the other holds the under surface of the knee.

Method of delivery.—The patient is drawn toward the edge of the table. The leg next the table should be extended. The other is brought down over the edge of the table, the operator grasping the under aspect of the knee. The thigh is then sharply flexed upon the abdomen, and the knee also is flexed, and brought to a point midway between the operator's knees, the foot resting upon his thigh. Downward pressure is next made with the hand upon the knee; at the same time the shoulder is pushed backward by the hand in contact therewith, thus producing by these movements a

decided rotation of the lower part of the spine. When the tension thus produced has reached the normal limit a quick thrust is given with either hand, namely the hips are brought forcibly forward and at the same time the shoulder is forced backward. The other side of the spine may be similarly affected by simply reversing the hold.

This hold is illustrated in Fig. 94.

CHAPTER V

Adjustment of the Ilium, Sacrum and Coccyx

Iliac Adjustment

The sacro-iliac articulation is a diarthrosis formed by the union of the sacrum and the ilium. The joint cavity is scarcely more than a capillary interval, is lined with a thin layer of hyaline cartilage and is firmly held in position by the sacro-iliac ligaments. This joint is therefore practically immovable as compared with other articulations of the body, insofar as functional motility is concerned. Some movement on applied stresses does, however, occur both under normal and abnormal conditions and it is with the latter that we are here concerned.

Subluxations of the sacro-iliac articulation may be produced in a variety of ways, the most common of which are the following: injuries of various kinds; a habit of bearing the weight on one leg in standing; occupations necessitating the assumption of a cramped or unnatural position.

There is no doubt that subluxations of this joint are directly responsible in turn for subluxations in other parts of the vertebral column in segments otherwise predisposed to displacement. A study of the architecture of the spine shows at a glance that when it is used as a column the base of this column is formed by the pelvis and that any irregularity there is bound to express itself in malpositions higher up. The chiropractor who keeps this thought in mind will be able, by correcting sacro-iliac subluxations, to obtain much better results in adjustment of other vertebral subluxations.

Many cases of sciatica are due entirely to sacro-iliac subluxation which, by causing a narrowing of the great sacro-sciatic foramen, induces impingement of the sciatic nerve.

Most sacro-iliac subluxations are a combination of a superior and posterior displacement. The ilium may also occasionally be subluxated inferiorly. The approximation of

the joint surfaces obviously makes any other form of displacement impossible.

Analysis of sacro-iliac subluxation is made by inspection and palpation. By inspection the relative position of the anterior-superior spines of the ilia are first noted with the patient in the upright posture. Following this, the analyst notes the position of the crest and the comparative level of the sacro-iliac dimples. The comparative length of the lower limbs is then noted, comparison being made between the heels, inner malleoli of the tibia, and inner aspect of the knee. Difference in the length of the legs indicates a tilting of the pelvis or iliac subluxation. To differentiate between these conditions a horizontal line is drawn through the spinous process of the fourth lumbar vertebra on a level with which the crests of the ilia are normally found. If one crest is below and the other above this line pelvic tilting is indicated; if one is on the line and the other above or below, it signifies subluxation of the ilium. These findings are best elicited with the patient in the prone position, the examiner standing at the subject's right side facing his feet. The thumbs are placed together on the spinous process of the fourth lumbar vertebra and the outer edge of each index finger is next placed against the crests of the ilia. With the hands so placed the respective position of the crests to the horizontal line through the fourth lumbar spinous process will readily be noted.

Tilting of the pelvis and sacro-iliac subluxation are always accompanied by more or less secondary lateral curvature of the lumbar spine. This is due to the attempt made by the patient to maintain a horizontal line of vision by curving the spine in proportion to the inequality of the relative level of either ilium. At the same time the limb corresponding to the superior side of the pelvis is shortened.

Tilting of the pelvis is always secondary to either a shortening of one limb or a lumbar scoliosis, while a sacro-iliac subluxation is primary and leads to inequality of the limbs and scoliosis. All three conditions are always associated in any case although their order of development varies.

Shortening of one of the legs may be due to tubercular hip disease, congenital dislocation of the hip, fracture of the neck of the femur or paretic contractures of the muscles of the limb. This is followed by tilting of the pelvis which is brought about by the inequality of the length of the limbs when the patient is standing or walking. To compensate for the pelvic tilt the lumbar spine gradually assumes a lateral curvature in the opposite direction.

Scoliosis may antedate and lead to either a pelvic tilt and shortening of one of the lower limbs. The scoliosis in such cases is primary in the thoracic spine while the curvature of the lumbar spine is compensatory therefor. Primary dorsal scoliosis may be brought on in a variety of ways, chief of which are rickets, empyema, faulty positions, carrying heavy weights on one side, injuries of the spine, and occupations. The compensatory curve in the lumbar region leads to tilting of the pelvis, and this in turn to shortening of the limb on one side.

It is necessary to determine in every case which of these three conditions was the first to develop. When this has been ascertained little difficulty will be experienced in arriving at a knowledge of whether the inequality of the ilia is due to pelvic tilting or to a sacro-iliac subluxation.

In this connection it must be remembered that the shortening of the limb, when secondary to scoliosis, pelvic tilting, or sacro-iliac subluxation, is not actual but apparent. By measuring each limb from the greater trochanter of the femur to the external malleolus of the tibia it can readily be learned whether either leg is actually shorter than the other. If the shortening is actual it is a furthr sign that this was the primary cause of the scoliosis, and pelvic tilting; if the shortening is only apparent and both legs are of equal length by measurement, it indicates that scoliosis and sacro-iliac subluxation were the primary causes of the difference in the position of the feet. The history of the case will establish which of the former factors was the first to develop.

Whenever sacro-iliac subluxation is suspected the attendant should keep in mind the possibility of tuberculosis of

this joint. This will be evidenced by pain, slight fever, and a disinclination to exertion. On account of the fact that there is no functional motion between the sacrum and ilium, the best sign of tuberculosis of a joint, limited motion, is wanting. It will, however, be observed that the patient moves about very cautiously. Usually there is a history of an injury in cases of tuberculosis of this as of other joints. Most physicians make a diagnosis of rheumatism in the absence of typical signs of tuberculosis, and overlook the possibility of subluxation of the joint. Tuberculosis is differentiated from rheumatism of the sacro-iliac joint by the age of the patient, the limitation of the trouble to a joint in which rheumatism rarely occurs, and by the slight afternoon rise in temperature.

Pain is a constant feature of sacro-iliac subluxation and is confined almost entirely to the subluxated side. It is of a dragging character, most subjects describing it as a sensation as if the hips were being pulled apart. This pain is not to be taken as diagnostic of subluxation, however, since tuberculosis and arthritis give rise to pain of the same character. Other associated symptoms and signs will serve to differentiate subluxation of the sacro-iliac joint from these conditions.

Tenderness is always present in sacro-iliac subluxation, but cannot be taken as a positive sign, inasmuch as it is also a symptom of other affections of this joint notably tuberculosis and arthritis. In the absence of other symptoms of the latter diseases, however, tenderness becomes confirmatory evidence of the presence of a subluxation of the ilium.

Adjustment of sacro-iliac subluxations may be made either directly or indirectly. The direct method implies contact with the ilium itself, whereas the indirect method employs other parts of the body as levers. Wherever possible the adjustment should be made by the direct method. At times this is difficult, in which event the adjustor will find it necessary to resort to the indirect methods which afford greater leverage.

The two direct methods most applicable to adjustment of the ilium are the Supra-Iliac and Infra-Iliac holds.

Fig. 95
Supra-Iliac Hold.

Fig. 96
Infra-Iliac Hold.

The Supra-Iliac hold is useful in correcting superior and posterior subluxations of the ilium. The patient should be in the prone position. The front section of the table is lowered and the rear end elevated, thus throwing the pelvis of the patient upward. If an adjustable table of this kind is not at hand a cushion may be placed beneath the pelvis. One hand is placed upon the crest of the ilium, and the wrist of the contact hand grasped with the other hand. The contact with the higher ilium having been obtained, a sudden thrust downward is delivered. This hold is illustrated in Fig. 95.

The Infra-Iliac hold is applicable to those rather rare instances where the ilium is subluxated inferiorly. The patient is in the prone position with the pelvis elevated. One hand is placed on the tuberosity of the ischium and the wrist of the contact hand grasped by the other hand. The thrust in this case is directed upward. This hold is illustrated in Fig. 96.

Three indirect methods of adjustment of sacro-iliac subluxations may be employed, using whichever is adapted to the individual case.

The first of these, the ilio-deltoid hold, illustrated in Fig. 93, is particularly applicable to postero-superior subluxations of the ilium. With this hold the adjustor can obtain an amount of leverage that will overcome virtually any degree of active or passive resistance.

Another indirect method which is applicable to many cases of superior sacro-iliac subluxations is forcible traction on the limb. Either leg may be used as the lever. When the shorter leg is used the ilium is directly drawn downward; when the longer leg is used the ilium and sacrum are drawn away from the suxluxated side momentarily, allowing the opposite ilium to move downward toward its normal alignment with the sacrum. The technic is as follows: The patient is in the dorsal position, the operator standing on the side of the limb to be used as the lever. Grasping the ankle the adjustor flexes the thigh upon the abdomen and the leg upon the thigh. Standing as far toward the subject's feet as possible he then makes a quick, forcible extension of the limb.

The attendant should be certain that no active or latent pathological process is present before attempting adjustment of the ilium. Obviously a thrust upon the ilium under such conditions would aggravate the condition to a degree that might lead to serious consequences. This is especially true of tuberculosis of this joint, which may lead to dissemination of the infection eventuating in iliac abscess and even a fatal termination. By keeping in mind the symptoms and signs of tuberculosis of the sacro-iliac joint the chiropractor will escape making such an error. The most reliable signs of tuberculosis of the sacro-iliac joint are the following: The patient limps on walking, but can stand on either leg; there is pain in the sacro-iliac joint, radiating to the hip and down the leg; tenderness is elicited on pressure over the joint and on pushing the ilia together; there is fullness over the joint, but the hip is never flexed unless an iliac abscess has developed. In the presence of these signs which not only indicate tuberculosis of the sacro-iliac joint but also distinguish it from caries of the spine and disease of the hip-joint, no adjustment should be made. The pelvis should be placed in a felt case and the patient remain in bed for several months. Any untoward developments should receive proper attention and consultation is often desirable.

Sacral Adjustment

The sacrum is so firmly wedged between the vertebral column superiorly and innominate bones laterally that luxation or subluxation of this bone is made impossible. Its individual units being united in the adult render subluxation of its component parts likewise impossible.

The only injury to the sacrum that is likely, therefore, is fracture, which is due to violence of considerable severity, as kicks, blows or gunshot wounds. In connection with such injuries there may be damage done the sacral nerves leading to loss of power of the rectum and bladder. It is accordingly necessary that the chiropractor be familiar with the symptoms and signs of fracture of the sacrum so that he will recognize it as a cause of disorders of the pelvic viscera when present, and not mistakenly ascribe them to another

cause. These symptoms and signs are pain, ecchymosis, crepitus, irregularity of the sacral spine, incontinence of urine and feces, and often paralysis in the area of distribution of the sacral plexus. Crepitus can be elicited by palpation with one hand externally and a finger of the other hand within the rectum. The lower fragment is displaced forward and may press upon or lacerate the rectum.

Sacral pain is exceedingly common and should always be correctly interpreted by the attendant. While pain in sacro-iliac subluxation is often referred to the sacrum, he should bear in mind the causes of sacral pain before assuming the existence of a subluxation of that joint. Recognition of the causes of sacral pain and the localization of the disorder will indicate a subluxation of a lumbar vertebra, adjustment of which will relieve the sacral pain by removal of the underlying disorder wherever this is possible. These causes of sacral pain are disease of the uterus, tubes or ovaries, pelvic inflammation, disease of the testicles, ulcer or cancer of the rectum, and hemorrhoids. Disease of the hip-joint also causes referred pain to the sacrum and the possibility of disease of this joint should be gone into carefully in all cases of sacral pain. Sciatica likewise causes sacral pain and the attendant should ascertain by a careful spinal analysis whether this is due to a sacro-iliac or lumbar subluxation

Employment of the sacrum as an adjusting lever is indicated in these conditions: Spondylolisthesis, lordosis and postero-inferior or anterior subluxation of the fifth lumbar vertebra.

The term **spondylolisthesis** implies a forward subluxation of the body of one of the lumbar vertebrae upon the vertebra below it. Usually, this displacement is of the fifth lumbar vertebra upon the sacrum. The degree of displacement may extend from a scarcely perceptible movement to a rotation of 90 degrees on the transverse axis. The condition is by no means uncommon and no spinal analysis is complete that does not take into account the possible presence of such a subluxation.

Inspection of the back shows the lumbar spine curved sharply forward above the sacrum; a lateral view shows

extreme prominence of the upper two or three spinous processes of the sacrum simulating kyphosis in other regions of the spine. The trunk appears shortened and the buttocks are prominent. When the forward displacement is pronounced, the spinous process of the fourth lumbar vertebra will be found below the horizontal line on level with the crests of the ilia. When such is the first observation made by the analyst he should not hastily conclude that he is dealing with a superior subluxation of the ilium or an antero-posterior tilting of the pelvis, but should keep spondylolisthesis in mind. Pain is present in all cases but is not particularly significant from a diagnostic standpoint.

The spinographic picture is characteristic and an antero-posterior view shows the top and bottom of the vertebra and the outline overlying the sacrum; a lateral view shows the fifth lumbar subluxated forward with a sharp bent in the spinal canal at the level of the subluxation.

Adjustment of this subluxation is possible in cases of moderate severity by using the ulno-spinous hold on the fifth lumbar vertebra or the supra-sacral hold on the sacrum or a combination of both these holds. When these methods do not suffice recourse may be had to adjustment under traction, and in more severe cases, where spinal rigidity is extreme, the adjustment may be accomplished under an anaesthetic.

Lordosis demands specific adjustment of the terminal vertebrae entering into the curvature and most of the results achieved must be ascribed to this procedure. It is, however, true that employment of the sacro-spinous hold in conjunction with such adjustments materially assists the adjustor in obtaining a correction of this deformity.

Postero-inferior subluxation of the fifth lumbar vertebra is a very common displacement and its frequency is readily explained by a study of the articulation between this vertebra and the sacrum. When the spine is in the vertical position, it will be observed that the inferior articular processes of the fifth lumbar set against the superior articular process of the first segment of the sacrum in a manner that forms a very unstable articulation, creating a constant tendency of the fifth lumbar vertebra to slide downward pos-

teriorly. A postero-inferior subluxation of this vertebra thus becomes one of the most common forms of subluxations encountered. Correction of such a subluxation is obtained by employment of the genu-transverse hold and the supra-sacral hold, singly or conjointly, as indicated.

Anterior subluxation of the fifth lumbar vertebra is possible but not common. In the writer's opinion most cases analyzed as anterior subluxations are either a postero-inferior subluxation, backward and upward tilting of the pelvis due to faulty posture, or spondylolisthesis. A direct anterior movement of the fifth lumbar is necessarily limited by the superior articular processes of the sacrum and is possible only in the degree of compression of the cartilage covering the opposing articular surfaces that may occur. The body of the fifth lumbar being thinner posteriorly than anteriorly favors forward movement of the vertebra to some extent. Any appreciable forward movement of this vertebra indicates, therefore, either dislocation or spondylolisthesis. When an anterior subluxation of the fifth lumbar is found its adjustment is effected by the bilateral pisiform-transverse or ulno-spinous hold on the fourth lumbar vertebra, together with the supra-sacral hold.

Apparent backward or forward displacement of the sacrum occurs in connection with lordosis and kyphosis respectively, and disappears after adjustment of such curvatures has been made.

Coccygeal Adjustment

The coccyx is made up from four, sometimes five, less often three, rudimentary vertebrae which usually become fused into one bone. The first segment articulates with the sacrum, the last is free and affords attachment for the fibres of the external sphincter ani muscle. From the posterior aspect of the first segment two processes (cornua) extend upward to unite with similar processes on the last segment of the sacrum and form a foramen for the transmission of the fifth sacral nerve. The one coccygeal spinal nerve emerges between the first and second segments of the coccyx. This nerve, the thirty-first pair of spinal nerves, is occasionally absent. In some cases one or

two additional pairs of minute filaments are found below the thirty-first pair. These are, however, rudimentary caudal nerves and do not emerge from the vertebral canal. Illustrations of the coccyx showing foramina at its sides with nerves emerging are, therefore, pure fabrications. Directly in front of the bone lies the ganglion impar, the point of fusion of the caudal extremities of the gangliated cords of the autonomic nervous system.

Subluxation of the coccyx is exceedingly common and no spinal analysis can be considered complete that fails to include palpation of this portion of the spinal column. The variety and gravity of disorders consequent upon malpositions of this bone have never been sufficiently appreciated. Many systemic as well as local disorders are due to subluxation of this vertebra, which, by its impingement upon the ganglion impar, causes a drain of nerve force that is responsible for a large number of cases of local and general depletion of the nervous system and asthenia of parts supplied thereby.

The coccyx may be subluxated forward, backward or laterally. In many instances such displacements are accompanied by some rotation, though this is limited by the nature of the attachment of the coccyx with the sacrum. Apparent forward or backward displacement of the coccyx in connection with a like change in position of the sacrum, due to kyphosis or lordosis of the lumbar spine, must not be confused with a true coccygeal subluxation.

The causes of coccygeal subluxation are in the main the same as those of other vertebrae. The most common cause is injury, the most usual being a fall on the base of the spine, which may produce either forward or backward displacement of the coccyx. Blows are also a not infrequent cause, resulting in forward displacement. Sedentary occupations often give rise to forward subluxation. A habit of bearing the weight on the sacrum and coccyx instead of the ischial tuberosities, when seated, gives rise to many cases of forward subluxation of the coccyx.

Those cases in which there is no history of an injury and in which none of the other causes mentioned above are

operative, may be due to static conditions which in turn are founded upon other abnormalities. Faulty positions on standing that come under this class are those due to flat feet, inequality in the length of the legs, or assuming an abnormal antero-posterior posture when standing. All faulty postures, especially the last-named, cause forward traction upon the coccyx by the pull of the gluteus maximus muscle exerted upon it.

The symptoms and signs of coccygeal subluxation are similar to those of subluxations of other vertebrae—pain, tenderness, immobility, symptoms referable to various parts of the body, and malposition of the bone.

In all cases the causes of referred pain over the coccyx should be excluded before displacement of the bone is assumed. The causes of such referred pain are hemorrhoids, anal fissure, anal fistula, ischio-rectal or perineal abscess, and disease of the uterus. A special examination will readily disclose the existence of any of these conditions. Negative findings in respect to those disorders make pain about the coccyx confirmatory evidence of its subluxation.

The posture of the patient, when seated is very significant of coccygeal displacement. He always avoids sitting in a cushioned chair because of the pressure on the coccyx; hence a hard chair is selected because the buttocks prevent the coccyx from touching the surface. The patient sits in a turned position, resting chiefly on one buttock. Standing and walking aggravate the pain, particularly walking up a flight of stairs. The pain is especially severe on defecation in forward subluxations due to the encroachment of the coccyx on the rectum. Tenderness over the coccyx is often extreme.

Diminished mobility or immobility of the coccyx is a feature of all coccygeal subluxations. Normally the coccyx is quite flexible, but after injury it frequently becomes attached to the sacrum. When immobility is absolute it becomes a sign of fracture with ankylosis of the coccyx to the sacrum.

The position of the coccyx is determined by palpation and radiography. The proper procedure for palpation of

the coccyx is as follows: The patient may be in the standing or prone position. When standing, he should lean forward with the forearms resting on a chair and the legs separated. When in the prone position, the pedal end of the table should be raised to elevate the pelvis or a cushion placed under the pelvis when an adjustable table of this kind is not available. The coccyx can be best palpated through the rectum as any subluxation can be readily felt by the finger in the rectum. The finger, well lubricated should be introduced slowly and the patient instructed to breathe easily and slowly and avoid straining or resisting. The finger is introduced high enough to palpate the sacrococcygeal junction and so placed that its palmar surface is in contact with the anterior aspect of the coccyx throughout its entire length. Any irregularity of position or change in size or form of the bone is then observed. By drawing the finger posteriorly, bringing the greatest stress on the tip of the coccyx, its mobility and the presence of ankylosis can be determined. Local tenderness and swelling are also elicited by this procedure. Contracture of the muscles attached to the coccyx are likewise taken note of at the same time. The examiner must keep in mind that the segments become united from below upward, the first and second not becoming fused until the age of twenty-five or thirty, to guard against mistaking mobility for separation of segments or an ununited fracture. If the condition of the anal canal is such as to make the introduction of the finger difficult or impossible (hemorrhoids, stricture, fissure, proctitis) the examination must be postponed until these conditions have been alleviated.

Radiography is more or less limited in its usefulness in analysis of coccygeal subluxations. The antero-posterior view shows lateral displacement; the lateral view shows anterior or posterior displacement, but exceptionally good technique is required to obtain proper results.

Adjustment of the coccyx is made according to the nature of the subluxation, the technique to be employed varying according to existing conditions.

When the coccyx is displaced anteriorly the following method should be employed: The patient may be in either

of the positions used for palpation. The adjustor stands at the patient's left side. The index finger of the right hand is introduced into the rectum and its palmar surface brought firmly against the anterior aspect of the coccyx; the heel of the left hand is placed upon the lower portion of the sacrum with the fingers at a right angle to its long axis. While firm downward pressure is made with the hand in contact with the sacrum a spontaneous movement is made posteriorly with the finger in contact with the coccyx.

When the coccyx is displaced posteriorly the patient and adjustor take the same respective position described above. The adjustor introduces the index finger of the right hand into the rectum bringing its palmar surface firmly against the anterior aspect of the coccyx. The palmar surface of the thumb of the left hand is placed upon the coccyx parallel with its long axis so that the end of the thumb is on the tip of the coccyx. A spontaneous thrust is then made upon the coccyx with the thumb, the finger within the rectum serving as a guiding check.

When the coccyx is displaced laterally the same technique outlined for adjustment of anterior subluxation is employed except that in a right laterality the thrust is applied toward the left side and in a left laterality it is directed toward the right side.

Adjustment of the coccyx should not be made more than twice a week, as the procedure is invariably attended by a considerable degree of reaction on the part of the antonomic nervous system.

When ankylosis exists between the coccyx and sacrum or between any two segments of the coccyx itself the attendant must determine as nearly as possible whether or not breaking of the ankylosis will be of benefit to the patient. If it can be reasonably expected that such a procedure will result in the bone reassuming its normal position or that its disunion will eventuate in complete absorption, the practice is justifiable. If, however, any doubt exists regarding the result of such a procedure the attendant should not attempt it. Breaking an ankylosis is in any event likely to do considerable damage to adjacent structures, and if it is appar-

ent that considerable force would be required to break such an ankylosis the idea should be abandoned, and the case referred to a surgeon, an excision of the coccyx is then indicated.

As already stated, the impingement of the ganglion impar, by a subluxated coccyx, gives rise to a multiplicity of disorders both systemic and local. Among the former may be included practically all abnormal states incident to nerve drain and there is no question that the results obtained by "rectal dilatation" must be ascribed to the stimulation of the ganglion impar incident to this procedure. The latter disorders are for the most part mechanical or irritative, due to the displacement of the coccyx itself. These include such conditions as hemorrhoids, proctitis and constipation. In view of the above it is apparent that many abnormal states intractable under adjustments elsewhere in the spine will yield readily to coccygeal adjustment.

CHAPTER VI

Regional Classification of Holds

In the following table the various subluxations in the different regions of the spinal column are given, together with the hold applicable in each:

Region of Spine	*Subluxations*	*Holds to Be Used*
Cervical	R. or L. Posterior	Temporo-Articular Hold T. M. Hold Unilateral Pisiform-Transverse Anterior Hold Digito-Articular Hold
	Lateral	Temporo-Articular Hold T. M. Hold Digito-Articular Hold
	R. or L. Inferior	Temporo-Articular Hold Fronto-Articular Hold Parieto-Articular Hold Occipito-Mandibular Hold I Occipito-Mandibular Hold II Occipito-Mandibular Hold III Digito-Articular Hold
	Scoliotic	Temporo-Articular Hold
	Anterior	Bilateral Pisiform-Transverse Anterior Hold
Dorsal	Antero-Inferior	Crossed Thumb-Transverse Hold Crossed Bilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Bilateral Digito-Transverse Hold Calcaneo-Spinous Hold Ulno-Spinous Hold
	Kyphotic	Thumb-Transverse Hold Crossed Bilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Pisiform-Spinous Hold Ulno-Spinous Hold
	Lordotic	Sacro-Spinous Hold
	Scoliotic	Unilateral Pisiform-Transverse Hold T. M. Hold (in upper dorsals) Ilio-Spinous Hold
	Inferior	Thumb-Transverse Hold Crossed Thumb-Transverse Hold Crossed Bilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Calcaneo-Spinous Hold

Region of Spine	*Subluxations*	*Holds to Be Used*
	Postero-Inferior	Crossed Bilateral Pisiform-Transverse Hold Thumb-Transverse Hold Digito-Tansverse Hold
Dorsal	R. or L. Inferior	Thumb-Transverse Hold Crossed Thumb-Transverse Hold Crossed Bilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Unilateral Pisiform-Transverse Hold
	Lateral	Unilateral Pisiform-Transverse Hold Angular Pisiform-Transverse Hold T. M. Hold
	R. or L. Posterior	Thumb-Transverse Hold Crossed Thumb-Transverse Hold Crossed Bilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Unilateral Pisiform-Transverse Hold Angular Pisiform-Transverse Hold Bilateral Digito-Transverse Hold Mandibulo-Spinous Hold T. M. Hold
Lumbar	Posterior	Bilateral Pisiform-Transverse Hold Calcaneo-Spinous Hold Thumb-Transverse Hold Pisiform-Spinous Hold Genu-Spinous Hold Flexed Genu-Transverse Hold (4 and 5 L.)
	Kyphotic	Bilateral Pisiform-Transverse Hold Thumb-Transverse Hold
	Lordotic	Sacro-Spinous Hold
	Scoliotic	Ilio-Spinous Hold Genu-Spinous Hold
	Inferior	Calcaneo-Spinous Hold Pisiform-Spinous Hold Genu-Spinous Hold Genu-Deltoid Hold Flexed Genu-Transverse Hold (4 and 5 L.)
	R. or L. Inferior	Bilateral Pisiform-Transverse Hold Unilateral Pisiform-Transverse Hold Genu-Spinous Hold Genu-Deltoid Hold Flexed Genu-Transverse Hold (4 and 5 L.)
	Anterior (5 L.)	Supra-Sacral Hold Bilateral Pisiform-Transverse Hold (applied on the 4th lumbar)

R. or L. Posterior	Thumb-Transverse Hold Pisiform-Spinous Hold Unilateral Pisiform-Transverse Hold Bilateral Pisiform-Transverse Hold Genu-Spinous Hold Flexed Genu-Transverse Hold (4 and 5 L.)
Antero-Inferior	Bilateral Pisiform-Transverse Hold Ulno-Spinous Hold Calcaneo-Spinous Hold Flexed Genu-Transverse Hold (4 and 5 L.)
Postero-Inferior	Bilateral Pisiform-Transverse Hold Flexed Genu-Transverse Hold (4 and 5 L.)

In the following table are given the different forms of subluxations, and the holds adapted to the correction of each depending upon the region of the spine in which they are situated.

Lateral Subluxation:

Cervical Region—

Temporo-Articular Hold.
T. M. Hold (6-7C).
Digito-Articular Hold.

Dorsal Region—

Unilateral Pisiform-Transverse Hold.
Angular Pisiform-Transverse Hold.
T. M. Hold (1-2-3D).

R. or L. Posterior Subluxation:

Cervical Region—

Temporo-Articular Hold.
T. M. Hold (6-7C).
Unilateral Pisiform-Transverse Anterior Hold.
Digito-Articular Hold.

Dorsal Region—

Thumb-Transverse Hold.
Crossed Thumb-Transverse Hold.
Crossed Bilateral Pisiform-Transverse Hold.
Bilateral Pisiform-Transverse Hold.

Unilateral Pisiform-Transverse Hold.
Angular Pisiform-Transverse Hold.
Bilateral Digito-Transverse Hold.
T. M. Hold (1-2-3D).
Mandibulo-Spinous Hold.

Lumbar Region—
Bilateral Pisiform-Transverse Hold.
Unilateral Pisiform-Transverse Hold.
Pisiform-Spinous Hold.
Genu-Spinous Hold.
Flexed Genu-Transverse Hold.

R. or L. Inferior Subluxation:

Cervical Region—
Temporo-Articular Hold.
Digito-Articular Hold.

Dorsal Region—
Thumb-Transverse Hold.
Crossed Thumb-Transverse Hold.
Crossed Bilateral Pisiform-Transverse Hold.
Bilateral Pisiform-Transverse Hold.
Unilateral Pisiform-Transverse Hold.
Genu-Spinous Hold.

Lumbar Region—
Bilateral Pisiform-Transverse Hold.
Unilateral Pisiform-Transverse Hold.
Genu-Spinous Hold.
Genu-Deltoid Hold.
Flexed Genu-Transverse Hold.

Inferior Subluxation:

Cervical Region—
Fronto-Transverse Hold.
Parieto-Transverse Hold.
Occipito-Mandibular Hold.

Dorsal Region—
Thumb-Transverse Hold.
Crossed Thumb-Transverse Hold.
Crossed Bilateral Pisiform-Transverse Hold.

Bilateral Pisiform-Transverse Hold.
Calcaneo-Spinous Hold.
Ulno-Spinous Hold.

Lumbar Region—
Calcaneo-Spinous Hold.
Pisiform-Spinous Hold.
Genu-Spinous Hold.
Genu-Deltoid Hold.
Ulno-Spinous Hold.

Posterior Subluxation:

Lumbar Region—
Bilateral Pisiform-Transverse Hold.
Calcaneo-Spinous Hold.
Ulno-Spinous Hold.
Pisiform-Spinous Hold.
Genu-Spinous Hold.
Flexed Genu-Transverse Hold.

Anterior Subluxation:

Cervical Region—
Bilateral Pisiform-Transverse Anterior Hold.

Lumbar Region—
Supra-sacral Hold.
Bilateral Pisiform-Transverse Hold (on the fourth lumbar vertebra).

Kyphotic Subluxation:

Dorsal Region—
Thumb-Transverse Hold.
Crossed Thumb-Transverse Hold.
Crossed Bilateral Pisiform-Transverse Hold.
Bilateral Pisiform-Transverse Hold.
Pisiform-Spinous Hold.

Lumbar Region—
Bilateral Pisiform-Transverse Hold.
Thumb-Transverse Hold.

Scoliotic Subluxation:

Cervical Region—
Temporo-Articular Hold.
T. M. Hold (in lower two cervical vertebrae).

Dorsal Region—

T. M. Hold (in upper three dorsal vertebrae).
Ilio-Spinous Hold.

Lumbar Region—

Ilio-Spinous Hold.
Genu-Spinous Hold.

Lordotic Subluxation:

Cervical Region—

Bilateral Pisiform-Transverse Anterior Hold.

Dorsal Region—

Sacro-Spinous Hold.

Lumbar Region—

Sacro-Spinous Hold.

Antero-Inferior Subluxation:

Dorsal Region—

Thumb-Transverse Hold.
Crossed Bilateral Pisiform-Transverse Hold.
Calcaneo-Spinous Hold.
Ulno-Spinous Hold.

Lumbar Region—

Bilateral Pisiform-Transverse Hold.
Ulno-Spinous Hold.
Calcaneo-Spinous Hold.

Postero-Inferior Subluxation:

Dorsal Region—

Crossed Bilateral Pisiform-Transverse Hold.
Thumb-Transverse Hold.
Digito-Transverse Hold.
Digito-Transverse Hold.

Lumbar Region—

Bilateral Pisiform-Transverse Hold.
Thumb-Transverse Hold.
Digito-Transverse Hold.

SECTION SEVEN

CHAPTER I

Specific Adjusting

Inasmuch as the functional activity and organic integrity of all parts of the organism and their harmonious relationship depend upon proper innervation, it follows that subluxation of vertebrae, by obstrucing the flow of nerve force to a part, become a factor of the greatest magnitude in the etiology of most diseases. It has already been shown how such subluxation may cause disease in one of six ways. It follows, therefore, that adjustment of such subluxated vertebrae must eventuate in a return to the normal state.

It is apparent that, given a specific disease, the chiropractor should have an accurate knowledge regarding the proper adjustments to be made. It is evident that the more specific the chiropractor can be in his adjustments, the more quickly and effectively will a result be accomplished.

There are a number of disadvantages connected with general adjustments—adjusting all vertebrae that are found subluxated. Chief among these is the fact that when a number of vertebrae are adjusted conflicting reactions may be obtained. For example: the stimulation obtained by a thrust over the ninth to twelfth dorsal vertebrae results in dilatation of the heart, whereas the effect of a thrust made upon the seventh cervical vertebra results in contraction of the heart. It would therefore be unwise to adjust both the seventh cervical and the ninth dorsal, because the effect of one adjustment counteracts the other.

It is because Chiropractic is more specific that it has achieved better results than any other school of healing founded on the mechanistic principle of the treatment of disease.

Obviously the chiropractor who hopes to make intelligent use of specific adjusting must be competent to make an

accurate diagnosis of the patient's ailment. Many systemic disturbances are due to an underlying disorder of a single organ. Accordingly a number of manifestations may be symptomatic of one specific organic disease. This is well illustrated by valvular heart disease, which gives rise to disturbances in a number of organs and to a variety of symptoms related to those organs. Thus the patient may have insomnia, gastric disturbances, constipation, congestion of the liver, cough, difficult breathing, swollen ankles, impaired kidney functions, etc. It would obviously be unwise to adjust the vertebra which is found subluxated in disorders of all those organs. The proper proceedure, on the contrary, would be adjustment of the vertebra which specifically is responsible for the abnormality of the heart, which in turn is the underlying cause of the other visceral disturbances. This naturally implies ability on the part of the chiropractor to correctly interpret the case and definitely ascertain that in this particular case the patient's condition is due to valvular disease of the heart. The same holds true of all other systemic disturbances.

If the chiropractor possesses a knowledge of symptomatology he can correctly apply the principles of specific adjustment. He must be able to determine, for example, whether pain in the shoulder is due to neuritis or gall bladder disease; whether an enlargement of the thyroid gland is due essentially to thyroid disease or ovarian disease; whether disorders of the genito-urinary tract are due to kidney disease or bladder disease. And unless he is able to make an accurate diagnosis as indicated in all cases, it would be preferable for him to adjust all vertebrae that he finds subluxated, in the hope that he will, in so doing, adjust the correct one, and incidentally not obtain any conflicting reactions. His position then becomes that of the physician who prescribes a "gun-shot" mixture in the hope that a certain ingredient may be effective.

The theory of "majors and minors" is found on the same clinical observation that underlies a principle of specific adjusting. The basis of this theory is, however, incorrect inasmuch as it assumes that mental impulses are in all cases restored to the affected parts. As observed elsewhere in this book, were that true a good procedure would be to sub-

luxate all vertebrae other than the one which has a specific bearing on the diseased organs, and thus divert all the mental impulses to that one organ until it has been restored to normal. The apparent senselessness of such a procedure shows that while the employment of "majors and minors" is correct, the explanation offered for its use is unsound.

Chiropractors should, insofar as possible, employ specific adjustments. There is no question that better results will be forthcoming. A review of the four ways in which the end result is obtained from adjustment of a vertebra, as indicated in the first section of this work, is ample evidence of the value of specific adjustments.

Incompatible Adjustments

The application of a thrust to a vertebra causes a certain amount of stimulation of the corresponding nerve centers. This stimulation produces a reaction in the corresponding segment of the cord which expresses itself in the organ which derives its innervation in whole or in part from that particular segment. For example: a thrust applied upon the eleventh dorsal vertebra will cause transitory dilatation of the stomach; a thrust applied over the first, second or third lumbar vertebrae will cause temporary contraction of the stomach.

It is evident, therefore, that organic diseases can be aggravated by adjustments if proper attention is not given to the effect of stimulation obtained by the chiropractic thrust. This is shown in a case of dilatation of the stomach, in which it would be manifestly unwise to adjust the eleventh dorsal vertebra because a thrust applied upon this vertebra has an effect of dilatation on this organ. The correct procedure on the contrary would be adjustment of the first, second or third lumbar vertebra, which has the directly opposite effect, namely, contraction of the viscus. True, the effect of stimulation produced by a thrust upon a vertebra is temporary, but in many diseases it may be sufficiently pronounced to markedly aggravate the disorders and greatly retard recovery.

For purposes of reference, the following table giving incompatible adjustments has been compiled, and there is no

question that adjustments made with reference thereto will add much to their efficacy.

INCOMPATIBLE ADJUSTMENTS

The Heart

(a) For DILATATION..........ADJUST: 9-12 D.
(b) For CONTRACTION ....ADJUST: 7 C.
(c) For INHIBITION...........ADJUST: 1-2-4 D.
(d) For STIMULATION ....ADJUST: 3-4 C.
(e) For Vagus Tone INCREASE.ADJUST: 7 C.
(f) For Vagus Tone DECREASE.ADJUST: 3-4 D.

Incompatible Adjustments:

9-12 D.—Incompatible with 7 C.
1-2-4 D.—Incompatible with 3-4 C.
3-4 D.—Incompatible with 7 C.

Clinical Application:

(a) DILATATION indicated in:

Valvular Stenosis.........ADJUST: 9-12 D. and 3-4 C.

(b) CONTRACTION indicated in:

Aneurism of the Aorta
Angina Pectoris
Dilatation of the Heart
Valvular Insufficiency ADJUST: 7 C.
Myocarditis
Pericarditis

(c) INHIBITION indicated in:

Pericarditis
High Blood Pressure ADJUST: 1-2 or 4 D.
Endocarditis

(d) STIMULATION indicated in:

Bradycardia ....ADJUST: 3-4 C.

(e) INCREASE IN VAGUS TONE indicated in:

Cardiac Asthma
Tachycardia
Palpitation
Arhythmia
Dyspnea ADJUST: 7 C.
Coughs
Angina Pectoris
Cardiac Weakness
Fatty Heart

(f) DECREASE IN VAGUS TONE indicated in:

Cardiospasm
Tobacco Heart ADJUST: 3-4 D.

The Lungs

(b) For DECREASE OF BLOOD IN THE LUNGS ....ADJUST: 10 D.

(a) For INCREASE OF BLOOD IN THE LUNGS ....ADJUST: 7 C.

(c) For CONTRACTION OF THE LUNGS ....ADJUST: 4-5 C.

(d) For DILATATION OF THE LUNGS ....ADJUST: 7 C. 3-8 D.

Incompatible Adjustments:

10 D.—Incompatible with 7 C.
4-5 C.—Incompatible with 7 C.—3 to 8 D.

Clinical Application:

(a) BLOOD INCREASE indicated in:

Tuberculosis ....ADJUST: 10 D.

(b) BLOOD DECREASE indicated in:

Congestion of Lungs
Bronchitis ADJUST: 7 C.
Bronchal Hemorrhage

(c) CONTRACTION indicated in:

Bronchial Asthma
Hay Fever ADJUST: 4-5 C. 1-2 D.
Emphysema

(d) DILATATION indicated in:

Tuberculosis
Pneumonia
Pleurisy ADJUST: 3 D.
Atelectasis

The Spleen

(a) For CONTRACTION........ADJUST: 1-2-3 L.

(b) For DILATATION ....ADJUST: 11 D.

Incompatible Adjustment:

1-2-3 L.—Incompatible with 11 D.

Clinical Application:

(a) CONTRACTION indicated in:

Anemia Splenitis Leukemia Enlarged Spleen Malaria Leukopenia	ADJUST: 1-2-3 L.

(b) DILATATION indicated in:

Infectious Diseases........ADJUST: 11 D.

The Stomach

(a) For CONTRACTION OF THE STOMACH..........ADJUST: 1-2-3 L.

(b) For DILATATION OF THE STOMACH ....ADJUST: 11 D.

(c) For MOTOR INCREASE (VAGUS) ....ADJUST: 1-2-3-4 or 7 C.

(d) For SECRETION INCREASE (SPLANCHNICS) ....ADJUST: 5-6-7 D.

Incompatible Adjustments:

1-2-3 L.—Incompatible with 11 D.

Clinical Application:

(a) CONTRACTION indicated in:

Haematemesis Dilatation of Stomach Gastroptosis Gastric Ulcer Acute Gastritis Atony Cardiac Insufficiency Pyloric Insufficiency	ADJUST: 1-2 or 3 L.

(b) DILATATION indicated in:

Pyloric Stenosis Pylorospasm Cardiospasm	ADJUST: 11 D.

(c) MOTOR INCREASE indicated in:

Hyperkinesis Peristaltic Unrest Nervous Eructations Nervous Vomiting Rumination	ADJUST: 1-2-3-4 or 7 C.

Pyrosis
Atony
Gastralgia

(d) GASTRIC JUICE SECRETION STIMULATION indicated in:

Chronic Gastritis
Bulimia
Akoria — ADJUST: 5-6 or 7 D.
Anorexia Nervosa

DIMINUTION indicated in:

Hyperchlorhydria
Nervous Hyper-secretion
Nervous Hypo-secretion — ADJUST: 5 and 11 D.
Achylia Gastrica

The Pancreas

(a) For CONTRACTION (To increase secretion).......... ADJUST: 4-5-6 or 8 D.

Clinical Application:

(a) CONTRACTION indicated in:

Pancreatitis
Diabetes — ADJUST: 4-5-6 or 8 D.

The Intestines

(a) For CONTRACTION......... ADJUST: 1-2-3 L.
(b) For DILATATION .... ADJUST: 11 D.

Incompatible Adjustments:

1-2-3 L.—Incompatible with 11 D.

Clinical Application:

(a) CONTRACTION indicated in:

Atonic Constipation
Enteritis
Appendicitis
Colitis
Enteroptosis — ADJUST: 1-2-3 L.
Intestinal Hemorrhage
Summer Complaint
(Infants)

(b) DILATATION indicated in:

Spastic Constipation
Nervous Diarrhea
Peristaltic Unrest — ADJUST: 11 D.

Enteralgia
Intestinal Obstruction

The Kidneys

(a) For CONTRACTION........ADJUST: 12 D.
(b) For DILATATION ....ADJUST: 6 and 10 D.

Incompatible Adjustments:

12 D.—Incompatible with 6 and 10 D.

Clinical Application:

(a) CONTRACTION indicated in:

Anemia Congestion Acute Nephritis Chronic Parenchymatous	ADJUST: 12 D.

(b) DILATATION indicated in:

Nephrolithiasis Function Minus Chronic Interstitial Nephritis Uremia Hydronephrosis Pyonephrosis Waxy Kidneys	ADJUST: 6 or 10 D.

The Liver

(a) For CONTRACTION........ADJUST: 1-2-3 L.
(b) For DILATATION ....ADJUST: 11 D.
(c) For SECRETION ....ADJUST: 4 and 8 D.
(d) For STIMULATION (thru VAGUS to HEPATIC PL..ADJUST: 3-4-5 C.

Incompatible Adjustment:

11 D.—Incompatible with 1-2-3 D.

Clinical Application:

(a) CONTRACTION indicated in:

Congestion Hepatitis Biliousness Torpid Liver Liver Cyst Abscess of Liver Hypertrophic Cirrhosis Catarrh of the Bile Duct	ADJUST: 1-2-3 L. Also 4 and 8 D.

(b) DILATATION indicated in:

Fatty Liver	
Waxy Liver	ADJUST: 11 D.
Acute Yellow Atrophy	Also 4 and 8 D.

The Gall Bladder

(a) For CONTRACTION........ADJUST: 4-5-6 D.

(b) For DILATATION ....ADJUST: 9 D.

Incompatible Adjustment:

4-5-6 D.—Incompatible with 9 D.

Clinical Application:

(a) CONTRACTION indicated in:

Cholecystitis ....ADJUST: 4-5-6 D.

(b) DILATATION indicated in:

Gall Stone Colic...........ADJUST: 9 D.

The Urinary Bladder

(a) For CONTRACTION ....ADJUST: 4 L. 11 D.

No other effect obtained.

Clinical Application:

(a) CONTRACTION indicated in:

Cystitis	
Enuresis	ADJUST: 4 L. 11 D.
Incontinence	

The Uterus

(a) For CONTRACTION ....ADJUST: 1-2-3 L.

(b) For DILATATION ....ADJUST: 10 D.

Incompatible Adjustment:

1-2-3 L—Incompatible with 10 D.

Clinical Application:

(a) CONTRACTION indicated in:

Endometritis	
Perimetritis	
Metritis	
Dysmenorrhea	
Menorrhagia	
Subinvolution	
Retroversion	ADJUST: 1-2-3 L.
Antiflexion	
Prolapse	

Hemorrhage
Polypus
Tumors

(b) DILATATION indicated in:

Amenorrhea
Leukorrhea ADJUST: 10 D.

The Prostate

(a) For CONTRACTION ....ADJUST: 12 D. 1-4 L.

Clinical Application:

(a) CONTRACTION indicated in:

Hypertrophy ADJUST: 12 D. 1-4 L.
Cancer of Prostate

The Aorta

(a) For CONTRACTION ....ADJUST: 7 C.

(b) For DILATATION ....ADJUST: 9 to 12 D.

Incompatible Adjustments:

7 C.—Incompatible with 9-10-11-12 D.

Clinical Application:

(a) CONTRACTION indicated in:

Aneurism ....ADJUST: 7 C.

(b) DILATATION indicated in:

Infantile Paralysis
Locomotor Ataxia ADJUST: 9 to 12 D.
Paralysis of the Lower Limbs

The Blood Pressure

(a) For REDUCED BLOOD PRESSURE ....ADJUST: 2-3-4 D.

(b) For RAISED BLOOD PRESSURE ....ADJUST: 6-7 D.

Incompatible Adjustments:

2-3-4 D.—Incompatible with 6-7 D.

Clinical Application:

(a) REDUCED BLOOD PRESSURE indicate in:
Hemorrhage ....ADJUST: 2-3-4 D.

(b) RAISED BLOOD PRESSURE indicated in:
Thrombosis ....ADJUST: 6-7 D.

Environmental Adjustment

A division of opinion exists in the profession regarding the methods to be employed by chiropractors in their work. Although considerable vehemence has been manifested in the discussion of this topic, which is popularly known as the "straight and mixing question," it is doubtful whether any chiropractor confines himself absolutely to spinal analysis and spinal adjustment in every case that is under his care. While a discussion of the politico-economic feature that has crept into this question is out of place in a work of this nature, its scientific consideration does come within the purview of a text-book whose scope covers the entire realm of the Principles and Practice of Chiropractic. For both the student and practitioner a discussion of the desirability and necessity of the employment of measures where indicated in connection with spinal adjustment is therefore appropriate in this place.

As already stated, no chiropractor confines himself exclusively to spinal analysis and spinal adjustments, because that would imply that he never uses the X-Ray, never advises a patient to go to bed, in short does nothing but adjust the vertebrae. Assuming, therefore, that all chiropractors at one time or another do employ measures that are the common property of all divisions of the healing art, and should employ such measures wherever indicated, reference is made to the more important ones in the chapters that follow.

In view of the undeniable truth that the existence of all natural things depends upon their adaptability to their environment, it follows that disease in the human organism means that the individual is out of tune with his environment. Hence, what we are pleased to term "Environmental Adjustment" takes on an importance of the first magnitude, and is second in importance only to vertebral adjustment.

It may be correctly said that everything affecting the individual is connected with his environment. Likewise all physiological processes of the organism and all that the individual does as he goes through life is designed to keep him in harmony with his environment and to make his environment more agreeable. When, accordingly, he is ill in mind or body, the disturbance from which he is suffering

is an indication that he is out of tune with his environment. Consequently, to adjust him to his environment is a necessary part in the bringing about of a removal of the abnormality with which he is affected.

This relates not only to the individual as a whole, as exemplified by a change in climate, but relates with equal force to any part of the organism, as would be illustrated by adjustment of the diet in gastric disorders.

Hence, while it is true that vertebral subluxations are an important etiologic factor in most diseases, it is necessary that the chiropractor carefully observe whatever indications may exist in a given case for adjustment of the patient to his environment. Environmental adjustment may accordingly be made to include everything done for the patient or directed to any functioning unit of the organism, whether it be adjustment of a change in climate, a correction of the diet, advice concerning his habits, or any other measure designed to correct or remove factors connected with his environment that have an etiologic bearing on the disease from which he is suffering. In so doing many contributing causes that make return to the normal state impossible so long as they are in operation are removed and a permanent restoration to normal is established.

Environmental adjustment increases or adds to the effectiveness of the vertebral adjustment. For example, in chronic constipation, while the restoration of the nerve-supply of the bowel is accomplished by adjustment of the subluxated vertebrae, correction of the diet is necessary when it is found that the patient is eating foods that are concentrated and leave so little residue that no action can occur even though the innervation is at par. The fact that other methods are used in connection therewith does not detract from the merits of the spinal adjustment, since these adjunct measures are merely assistive agents, in any case, in the same manner that drugs are, be it constipation or any other disease.

Environmental adjustment is often required to remove contributing causes of disease. It would be manifest folly to permit a patient with Bright's disease to eat irritating foods, one suffering from heart disease to exercise violently, or one having cirrhosis of the liver to use alcohol. On the

other hand, a proper diet should be prescribed, moderate exercises advised, and liquors interdicted in each case respectively.

Nearly all diseases are accompanied by a greater or less toxemia of some kind or nature. It is true that restoration of the functional activity of the secretory and excretory organs through vertebral adjustment will ultimately rid the organism of these toxins. Nevertheless, a more rapid elimination of the toxins is often necessary to save the patient's life. In many acute diseases it is the toxemia which produces dangerous symptoms, and speedly elimination is absolutely necessary. For this reason, adjustment at the tenth dorsal segment which stimulates the kidneys, and the upper lumbar segments which influence the bowels, together with hot baths, are given to increase the eliminative function of the skin and bowels.

Dangerous symptoms may arise at any time in the course of some diseases, and even result in the patient's death before the cause can possibly be corrected, and the dangers obviated, by vertebral adjustment. The temperature in an acute disease, as typhoid fever, may rise to a degree that may menace the life of the patient. This fever is due to an unusually virulent toxemia and immediate steps must be taken to reduce the temperature by artificial means when the patient's life is in danger.

Other measures have shown their effectiveness in different diseases, and should therefore be used. Vertebral adjustment is not to be regarded as all in all in disease and other measures which are of proven value should be considered. Such measures may be successfully combined with vertebral adjustment. Reasons for the desirability of using some of these measures have been given above. These illustrations should serve to show that their use is a rational and logical procedure, yet does not detract in the slightest from the merits of chiropractic.

Lastly, there are certain diseases and conditions that are impossible of cure by any known method and it would therefore be folly to employ adjustment in them. Such diseases as advanced tuberculosis, cancer, etc., are accompanied by such profound destruction of tissue elements that recovery is impossible. Not only the organs primarily af-

fected, but the entire "house in which we live" is falling to pieces, and nothing can replace that which has been destroyed. Chiropractors should be able to recognize such conditions, as nothing is more reprehensible than taking cases that are manifestly incurable.

There are other conditions which belong so manifestly in the realm of surgery that attempts to relieve them by vertebral adjustment alone are irrational and ill-conceived, and show an ignorance of pathology. Most tumors, for instance, are amenable to no treatment other than excision.

With all these facts in mind, it remains true, as clinical results conclusively show, that of all methods chiropractic is the most valuable single measure known.

CHAPTER II

Infectious Diseases

Typhoid Fever

Etiology.—The predisposing cause of typhoid fever is a subluxation of the lower dorsal or upper lumbar vertebrae which, by lowering the vital resistance of the intestinal tract, make it a favorable habitat for bacteria. The exciting cause is the bacillus typhosus. Contributing etiological factors are adolescence, temperature climate, spring and autumn months, contaminated water and milk.

Pathology.—The Peyer's patches undergo enlargement, necrosis, ulceration, and finally scar-formation. The lower part of the small intestine and the upper portion of the large intestine are principally affected. Enlargement of the spleen and mesenteric glands is present.

Symptoms.—The onset is gradual, lasting about two weeks, during which time there may be headache, malaise, loss of appetite, and nose-bleed. Sometimes the disease begins as meningitis, or pneumonia, or acute Bright's disease. The diagnosis is sometimes difficult, in these cases. FIRST WEEK—Fever, which in typical cases rises gradually, being a degree higher each day, while the morning temperature is one degree lower than that of the preceding evening. The abdomen is distended, tender, and bubbling and gurgling on the right side is frequent. Cough is common. Headache is constant and severe. The pulse is dicrotic. There may be diarrhea. SECOND WEEK—The symptoms of the first week continue, and are aggravated. Rose-spots appear upon the abdomen and chest, and rarely over the entire body. These spots are very small, slightly raised, bright red, and disappear on pressure. The fever is continuously high, 103° to 106° and about one degree lower in the morning than in the evening. The spleen is enlarged. The pulse is feeble, but relatively slow, around 100, and not at all in proportion to the height of the fever, which is characteristic. The tongue is coated except at the tip and edges, where it has a red,

glossy appearance. The nervous symptoms include delirium, stupor, mental apathy and in severe cases, the "typhoid state," which is a condition of profound collapse. The more violent the delirium, the better the prognosis, while the outlook in a patient with low, muttering delirium is bad. THIRD WEEK—The fever gradually falls, but the general weakness is increased. There is emaciation, rapid pulse, and spasms of the muscles. The general condition, however, is marked by gradual improvement. But in the worst cases the symptoms of the second week continue and become progressively worse. FOURTH WEEK—Convalescence commences, and the symptoms gradually disappear. Other less common symptoms occurring during the course of the disease include perspiration, jaundice, hemorrhages, erythema, hiccough, and persistence of the appetite. The temperature may be of any kind or type.

There is present marked tenderness of the twelfth pair of thoracic nerves, especially the one on the right side. This is due to the pathological condition of the lower portion of the ileum, which receives its innervation from the eighth segment of the spinal cord, and which nerves make their exit between the twelfth thoracic and first lumbar vertebrae. There is contraction of the ligaments on the right side of the twelfth thoracic segment, marked tenderness of the twelfth thoracic nerve on the right side, and increase of temperature of this segment, owing to the pathological changes in Peyer's patches. There is tenderness of the nerve at the sixth thoracic spinal segment on the left side, contraction of the ligaments and increased temperature, owing to the involvement of the spleen.

Adjustment.—When the case is seen early, all the symptoms enumerated above usually do not develop, unless the infection is exceptionally virulent or the vital resistance of the patient is very low. Adjust the atlas to relieve nervous symptoms and reduce fever; the fifth cervical for stimulation of the innervation to the thyroid glands; the sixth thoracic for its effect upon the spleen; the eighth, tenth and twelfth thoracic for their effect upon the intestines and the second lumbar, if so indicated.

Hygiene.—When the disease is first suspected, the patient, after having been properly adjusted, is given a bath,

put to bed, given an enema, put on a liquid diet, and an ice-cap placed on the head. The patient should not leave the bed until recovery is complete. Every morning a bath is given, the back is sponged with alcohol, and dusted with talcum powder to prevent development of bed-sores. In cases with marked delirium or high fever, different kinds of baths are valuable. The cold tub, the sponge bath, the cold pack and the alcohol sponge are all useful. The kind of bath depends upon the strength of the patient, and the severity of the nervous symptoms. If the temperature is not above 103°, baths may be discontinued. If the temperature is high only in the evening, and the nervous symptoms are not severe, a cold sponge during the course of the night will suffice. In grave cases, the sponge bath, or any of the other varieties of baths, can be employed. It is advisable to give baths not oftener than every three hours in any case. The water should be about 80°, and the patient should remain in the bath not longer than twenty minutes. Vigorous massage of the extremities adds to the efficacy of the bath. It is not advisable to move the patient to any extent.

Diet.—Thin meat broth or milk every three hours, about a cupful at a time. Water should be taken in large quanties. Other articles permitted during the height of the fever are lemonade, water with a little white of egg added, buttermilk, orange juice, and purees of barley, oat-meal and rice. When the temperature goes down, one or two egg-nogs a day may be given. If the bowels do not move during the day, give an enema of soap-suds. For diarrhea, change the diet; if milk is being given, boil it; or change to meat broths, if diarrhea persists.

Small-Pox

Etiology.—The primary and indirect cause is a low state of vital resistance as a result of faulty innervation. This permits the growth of the organisms and the elaboration of their toxins in the system to take place. The direct and secondary cause is probably an intra-cellular parasitic protozoon, the Cytoryctes variolae. There is no period from the initial fever to the period of peeling when the disease is not contagious, although during the stage of suppuration the disease is most communicable.

Pathology.—The eruption with its four stages, namely, macule, papule, vesicle and pustule, is the only distinctive pathology. A depressed spot in the apex of the pustule indicates the area of necrosis. Granular and fatty degeneration of the liver, spleen, heart and kidneys is present. The pustules sometimes are seen in the larynx, trachea, bronchial tubes, and pleura.

Symptoms.—There is an incubation period of from ten to fifteen days. The onset is sudden with a chill, vomiting, and severe pain in the head and back. The initial rash appears on the first or second day and resembles that of measles or scarlet fever; this rash appears principally on the inner surfaces of the thighs. On the fourth day of the disease, the true eruption of small-pox appears, on the forehead, wrists, back and elsewhere, as macules having a hard shotty feel. On the fifth and sixth day these change to vesicles, the apex of which is sunken, and which do not collapse when pricked with a needle. On the eighth day pustules appear, surrounded by a red zone. On the eleventh day crusts form, which later fall off. The initial fever rapidly rises to 103°-104°, with a drop to normal from the fourth to the eighth day. When the true eruption appears, a secondary rise of temperature occurs. Constitutional disturbances are severe, and delirium and the "typhoid state" frequently are met with. Tenderness of the nerves of the fifth and seventh thoracic segments is present in nearly all cases of small-pox.

Adjustment.—Adjust the fifth cervical and the fifth or sixth and tenth thoracic vertebrae. Adjustment of the fifth cervical vertebra is claimed by some to be a specific in small-pox. The diet should consist of milk, broths, and other easily digestible foods. For fever and nervous symptoms adjust the atlas.

Varicella (Chicken-Pox)

Etiology.—The direct cause of this disease is unknown. Being of an infectious and contagious nature, however, it may be correctly assumed that the primary and indirect cause is a state of impaired resistance, due to faulty innervation.

Symptoms.—The incubation period is from ten to four-

teen days. The onset is sudden, with vomiting and backache at times. A moderate rise in temperature. The eruption, at first papular, soon becomes vesicular. The vesicles appear on the first day of the disease, and are commonly single, distributed over the entire body, few in number, and collapse on pricking with a needle. On the third or fourth day pustules appear, which soon dry up and form brownish crusts.

Adjustment.—Adjust the fifth cervical and fifth and tenth thoracic vertebrae. The disease always terminates favorably. Otherwise the adjustment is symptomatic.

Scarlet Fever

Etiology.—The indirect and primary cause is a lack of resistance due to faulty innervation, as a result of vertebral subluxations. The direct and secondary cause is a special micro-organism, which retains its infecting power for at least one year. The poison is scattered by the scales in the air, clothes, food, etc. The respiratory tract is generally the atrium of infection, but the digestive tract may also convey the poison. Children are most susceptible to this disease. Second attacks are unusual, but do occur.

Pathology.—There is no characteristic morbid anatomy. The skin is the seat of acute inflamation which fades away. There is granular degeneration of the liver, spleen, stomach, kidneys, heart and muscles. The throat is the seat of inflamation, and sometimes ulceration.

Symptoms.—The incubation period varies from two to four days. The onset is sudden, often with a chill, vomiting, and spasms. The condition of the throat varies from a mild angina to severe ulceration. The eruption appears on the first or second day, and resembles a vivid red blush; it first invades the neck, chest and arms, and then becomes general; a characteristic feature is that a portion of the face about the mouth is not covered by the eruption and appears very white in contrast with the balance of the face. It fades rapidly, and it may be quite itchy. The peeling is characteristic, and begins soon after the eruption disappears. It is fine and scaly on the body, but from the feet and hands whole casts may come off; it lasts two weeks or more. The fever rises rapidly to 103°-106°, and there is rapid pulse and often delirium. It falls to normal in from three to ten days.

The tongue has the appearance of a strawberry, showing enlarged fungiform papillae. The cervical glands are enlarged. Acute Bright's disease is apt to develop from the 3rd week, and the urine contain albumin. In all cases the kidneys are affected early. If, however, albumin is still present in the urine after the third week, permanent kidney trouble will probably result. Complications and sequelae include nephritis, middle ear disease, Arthritis, Endocarditis, Myocarditis, Pericarditis, Pleurisy, Ludwig's angina, Broncho-pneumonia, Chorea, Paralyses, and Noma.

Adjustment.—Adjust the 4th cervical and the 5th and 10th thoracic vertebrae, and make any other adjustments which may be indicated, after a careful spinal analysis has been made. Strict quarantine until desquamation is complete. The patient should be isolated. Disinfecting measures to the saliva and peeled skin. Diet should consist of milk. An abundance of water should be drunk, to relieve the work of the kidneys as far as possible. Apply olive oil or carbolated vaseline to the skin when peeling commences to prevent scattering of the scales. Supportive measures as required. The patient should not be allowed to leave the bed, until after the third week on account of the danger of complications, especially Bright's disease.

Measles

Etiology.—The exciting cause is an unknown microorganism, which may be transmitted through a third party, and in various other ways. It is seen usually in children, although adults sometimes contract it. It is generally epidemic. Second attacks are uncommon, but may occur.

Pathology.—No characteristic lesions are present. The kidneys may be the seat of albuminous degeneration or acute nephritis. Broncho-pneumonia or enlargement of the bronchial lymph glands may develop.

Symptoms.—The incubation period varies from ten to fourteen days. The onset of the disease is sudden, a chill or chilliness, fever of 101° to 102° F., muscular soreness, headache, and intense catarrh of the nose and throat, being the first symptoms. There are present also redness of the eyes, aversion to light, sneezing and coughing. On the second day the fever drops, but rises again on the fourth day, when an

eruption of small, dark red, velvety papules appears, first on the face, and rapidly spreads over the entire body. The catarrhal symptoms still persist. There is itching and burning. On about the ninth day the rash begins to fade and soon disappears entirely by bran-like desquamation. Koplik's spots, which are bluish white spots found on the mucous membrane of the cheeks, are supposed to be pathognomonic of measles. Black measles is that variety in which the eruption is hemorrhagic and there is great prostration. It is encountered in places in which faulty hygiene exists.

The most common complications are catarrhal pneumonia and catarrh of the stomach and intestines. The most common sequelae are tonsillitis, tuberculosis, and cancrum oris.

Adjustment.—Adjust the 4th and 6th cervicals, and the 3rd, 5th and 10th dorsals. The patient should be kept in bed, in a warm but well ventilated room. The eyes should be kept clean and protected from the light. The mouth also should be frequently cleansed. For high fever, adjustment of the atlas and sponging or tepid baths gradually cooled. During desquamation oil and bathe the skin. Guard the patient against exposure during convalescence, in order to avoid broncho-pneumonia and tuberculosis.

Rubella (German Measles)

Etiology.—The direct cause is unknown. The disease is seen in epidemic form most often, and spreads rapidly.

Symptoms.—The incubation period is from 10 to 14 days. The onset is sudden, and the rash appears at once, and consists of bright red macules and papules. The cervical lymph glands are often enlarged. Slight rise in temperature. Mild coryza and sore throat.

Adjustment.—The adjustment indicated under measles are applicable to this disease.

Epidemic Parotitis (Mumps)

Etiology.—The predisposing cause is a subluxation in the upper cervical region. The exciting cause is at present unknown. It occurs in epidemic form although sporadic cases are seen. Females are less susceptible than males, and the disease occurs most commonly between the ages of 5 and 15 years.

Pathology.—One or both parotid glands are inflamed and in severe epidemics the cellular tissue of the gland is involved. The inflamation first involves the gland ducts and quickly extends to the gland proper. Sometimes the submaxillary gland, the ovaries, testes and mammary glands are involved. Secondary paritthe occurs as a complication in severe bloodpoisoning, and ends in suppuration and destruction of gland-structure.

Symptoms.—The incubation period lasts from 2 to 3 weeks. The onset is sudden and marked by mild fever. One parotid gland is swollen and painful; two or three days later the opposite gland becomes affected. Dysphagia and often earache; inflamation of the testes in the adult may be the only evidence of the disease, which lasts about one week. Orchitis is the most common sequel, and may result in sterility. Chronic enlargement of the gland, and deafness may also result.

Adjustment.—Make adjustments in the upper cervical region, since from here is derived the innervation to the salivary glands; the 5th dorsal vertebra should be adjusted, since from this segment there seems to be a specific influence in this disease. The disease may thus be cut short. The lower dorsal vertebrae should also be adjusted. Locally, a hot compress or an ice bag is of service. Hygienic measures that are indicated should be employed.

Whooping Cough (Pertussis)

Etiology.—The disease is contagious and is due to an unknown microorganism, which attacks patients of low vitality, the primary cause of which is disturbed innervation. It is a disease of childhood, fully one-half of the cases occurring during the first two years of life. Adults may, however, be affected. Second attacks are uncommon.

Pathology.—No characteristic lesions are present.

Symptoms.—The incubation period varies from 1 to 2 weeks. For the first one or two weeks there is cough, which gradually becomes spasmodic. Slight fever, and coryza then develop. This stage is followed by the characteristic whoop, which is a sharp, inspiratory sound following a series of short expiratory coughs. Such paroxysms occur many times a day, and during the paroxysm the face becomes

blue, the eyeballs protrude, an anxious expression of the face is present and involuntary urination occurs. Loss of weight and strength, and anemia often follow. Nearly all forms of lung diseases may occur as complications of, or sequelae to, whooping cough, as well as disorders which result from the violent coughing, as apoplexy, cardiac dilatation, and conjunctivitis.

Adjustment.—Adjust the 4th and 6th cervical for the relief of the catarrhal symptoms. Adjustment of the 3rd and 5th dorsals has a specific action on this disease, and if given at the onset of the disease, will serve to cut it short. The patient should be isolated if possible. In severe cases rest in bed is indicated.

Influenza (La Grippe)

Etiology.—The direct and secondary cause is the influenza bacillus (Pfeiffer). The indirect and primary cause is faulty resistance, due to improper innervation, and it is only in the presence of such a state of depleted vitality that the disease can develop.

Pathology.—No characteristic lesions are present. Sometimes an exudate inflamation of the respiratory, nervous and digestive systems is present.

Symptoms.—The incubation period lasts from three to four days. The onset is usually sudden, with a chill and all symptoms of a fever due to general infection. The symptoms depend upon the region affected. There are several forms of Influenza, among which the following are the most common: (a) The *respiratory* form, which begins like a severe coryza, with fever, pain in the eyes, backache, pains in the extremities, and profound prostration. Symptoms of bronchitis, pleurisy, or pneumonia may develop. (b) The *nervous* form, in which the characteristic symptoms are severe headache, pain in the back and extremities, and prostration. The disease may, however, be so severe that symptoms of meningitis, neuritis, and mental disorders develop. (c) *gastro-intestinal* form, which begins with symptoms of acute gastritis, namely, nausea, vomiting, epigastric pain and fever; or of acute colitis, namely fever, colic, diarrhea and occasionally jaundice.

Adjustment.—Adjust the 4th cervical and the 3rd, 5th,

7th and 10th dorsal vertebrae. Concussion over the 7th cervical may abort the attack. The patient should remain in bed in a warm, well-ventilated room; the bowels should be regulated. Liquid diet. Hot baths to induce free perspiration.

Erysipelas

Etiology.—The direct cause is the Streptococcus erysipelatus; the primary and indirect cause is vertebral subluxations, which, by diminishing the innervation, produce a low grade of vital resistance. The disease is seen most commonly in March and April, in alcoholics or patients having Bright's disease.

Pathology.—The involved skin is inflamed, thickened and edematous. Suppuration or gangrene of the skin may develop; meningitis from extension; and involvement of various viscera.

Symptoms.—The incubation period is from 3 to 7 days. The onset is sudden, with a chill. The eruption is a bright red flush and its margin is raised and clean-cut. The eruption commences on the bridge of the nose and to either side of it, and extends to the mouth, ears, neck and even the arms. The face is disfigured; the eye-balls are swollen, and the conjunctiva is inflamed; the skin is hard and edematous, and large blisters may form. The temperature is raised to 104° or even 106°. The disease lasts 4 to 5 days, when the fever falls by crisis; if however, the area affected is large, the disease is prolonged for some time.

Adjustment.—Adjust in accordance with the location of the disease; adjust the 10th dorsal vertebra in all cases. Compresses should be applied to the affected parts. The bowels should be regulated. Liquid diet. The fever can be reduced by adjustment of the atlas and cold sponging.

Rheumatic Fever (Acute Articular Rheumatism)

Etiology.—The primary cause of rheumatic fever is faulty innervation first of the tonsils which makes them a favorable culture medium for the bacteria which are the direct cause of the disease; second, the nervous system in general may be disturbed; third, subluxations present may result in defective metabolism with consequent accumulation in the body of poisonous substances.

Pathology.—The affected joints are markedly hyperemic and the synovial membrane and surrounding ligaments are swollen. Erosions of the cartilages. Edema of the joint and surrounding structures occasions considerable swelling and the pain is no doubt due to the stretching of the tissues and pressure on the nerves.

Symptoms.—The disease commences suddenly, with a rise in temperature to 103°-105°. The affected joints are red, swollen, intensely painful and tender. A characteristic feature is the migration from one joint to another. Acid sweats, which produce tiny vesicles. The urine contains a heavy sediment of urates. Skin eruptions are common. There is a tendency to recurrence. Simple Endocarditis is a very common complication. Myocarditis and Pericarditis are sequelae. The disease may be complicated by pneumonia, Bright's disease, or chorea, or may merge into the chronic form if reflex vertebral subluxations are not corrected; these lesions invariably occur in the spinal segment which controls the affected joint.

Adjustment.—Adjust the 5th and 10th dorsals, and also the segments controlling the parts which are affected. This will cause a favorable termination, prevent chronic rheumatism, and obviate complications. One of the most effective remedies in acute articular rheumatism is the application of hot packs over the affected joints. In all cases the patient should be placed at absolute rest in bed. He should wear woolen garments, and blankets should be used, care being taken to protect the inflamed joint from excessive weight of the coverings, by using a tent. The diet should consist of easily digested substances, preferably milk. Water, especially the alkaline mineral waters, should be freely used. After the process has become subacute, adjustment should be continued. Warm baths, and cautious massage are often helpful in removing the stiffness of the joints.

Dysentary (Bloody Flux)

Etiology.—The primary cause of this disease is vertebral subluxations in the lumbar region, which, by interfering with the innervation of the intestine, render it susceptible to the invasion of the contributing causes, which are most commonly errors in diet, impure drinking water, sudden

changes in temperature, and faulty hygiene. It occurs most frequently during the summer and autumn months, and in tropical climates.

Pathology.—Inflamation, enlargement of the lymph follicles, excessive secretion of mucus, and sometimes ulceration of the large bowel.

Symptoms.—The incubation period is one or two days. The onset is sudden, with fever, pain in the abdomen, and diarrhea. The stools contain mucus and later blood; they become very frequent, with extreme thirst, and violent pain. The fever may be 103° to 104°. The acute catarrhal dysentery is the mild variety. Diphtheritic dysentery is a type in which there is great congestion and necrosis of the lining of the intestine, and it often follows other diseases, as pneumonia, heart disease, and Bright's disease.

Adjustment.—Adjust the 10th dorsal, 2nd lumbar, and coccyx. The patient should be continuously confined to bed in even the mildest attacks. The discharges should be disinfected. The diet should be bland and unirritating. Substances such as milk and lime-water, broths and egg-albumin should be given in acute attacks. In chronic cases the diet may be semi-solid.

Tuberculosis

Etiology.—The direct and secondary cause is the tubercle bacillus. The indirect and primary cause is subluxation of the first, second or third dorsal vertebra, producing faulty innervation, and resulting in a low grade of resistance. Predisposing causes are a family predisposition; unhygienic surroundings; debilitated states; improper food; occupations requiring the breathing of fine particles of dust or mineral matter; other lung diseases; chronic diseases of all kinds; trauma.

Pathology.—The characteristic lesion is the tubercle. This is usually in the lungs in adults; lymph glands, bones and joints in children. At the site of the infection the germs multiply rapidly; at the same time leucocytes gather at this point and the cells proliferate. This entire mass is devoid of blood-vessels and constitutes the tubercles which are irregularly round, pearly and gray. The action of the germs and their toxins and the absence of blood supply

causes the center of the tubercle to become necrotic until the whole is converted into a yellowish, cheesy mass. This may either become encapsulated and calcified, or the process may continue until cavities are formed in the parts affected.

Pulmonary Tuberculosis (Consumption; Phthisis)

There are four varieties of Pulmonary Tuberculosis: 1, Acute miliary tuberculosis; 2, Pneumonic phthisis; 3, Tubercular phthisis; 4, Fibroid phthisis.

Acute Miliary Tuberculosis (Acute Phthisis; Galloping Consumption)

Etiology.—In the majority of cases it is the result of an autoinfection, arising from either an active or latent tuberculosis focus in persons of a low grade of vital resistance due to faulty innervation. It sometimes follows measles, whooping-cough, small-pox, and influenza. It is most common between the age of puberty and middle life. For the deposition through the body of the tubercles, under the influence of certain forms of irritation, it is essential that the resistance of the patient be diminished.

Pathology.—The miliary tubercle consists of a fine network of fibres, containing a mass of cells and granules, and often having a giant cell for its center. The deposit is generally over both lungs and the bronchial tubes, and is followed by congestion, a viscid secretion, and all tissues with which it comes in contact are destroyed.

Symptoms.—Several forms are met with: (a) The typhoid form, in which the fever very much resembles that of typhoid. The other symptoms of the latter disease are, however, wanting. (b) The meningeal form, in which symptoms of basal meningitis, tubercular meningitis, and hydrocephalus are present. (c) The Pulmonary form, in which the usual symptoms of tuberculosis are present in an aggravated form.

Pneumonic Phthisis (Chronic Catarrhal Pneumonia)

Etiology.—This form of tuberculosis is dependent primarily upon a low resistance which permits of the multiplication of the tubercle bacilli, and the elaboration of their toxins. Among contributing causes may be mentioned poor hygienic surroundings, a scrofulous tendency, catarrhal

pneumonia, especially at the apex of the lung, and the continuous inhalation of irritant particles. Sometimes the disease follows one of the acute infectious fevers.

Pathology.—The bronchioles and air vesicles are filled with a cheesy material, which is a necrotic mass of dead leucocytes, germs, cells, etc. The affected areas of the lung soften and are converted into abscess cavities. The process is situated most commonly at the apex of the lung. The pleura are prone to be affected.

Symptoms.—Pneumonic phthisis is seen in three forms: Acute, subacute and chronic.

The *acute* forms run a very rapid course, beginning either as a croupous or catarrhal pneumonia, which affects one whole lung, or parts of each lung, and is accompanied by a high temperature; night-sweats; dyspnea; severe cough; abundant purulent, and blood-streaked expectoration; impaired digestion and loss of appetite; rapid loss of flesh and strength.

The *subacute* variety is generally preceded by pneumonia of one or two weeks' duration, from which the patient does not entirely recover. After a few weeks or months, softening of the lung, followed by destruction and the formation of cavities occurs. These changes are accompanied by the usual symptoms of pulmonary tuberculosis, and in unadjusted cases the course is about one year.

The *chronic* form commences insidiously, a history of previous susceptibility to colds and catarrh being present. A chronic cough with muco-purulent expectoration develops, and each time the patient has a "cold," fever, pain in the chest, and mild haemoptysis accompany it. Finally the characteristic symptoms of tuberculosis, namely morning chills, evening rise in temperature, profuse night-sweats, distressing cough and expectoration are present.

Physical Signs.—Inspection shows the respiratory movements over diseased portions of the lungs, increased in frequency and diminished in force. Palpation over consolidated areas shows increased vocal fremitus. The percussion note at the apex varies from slight impairment of the normal note to dullness, and when cavities are formed there are present scattered areas over which the tympanitic or hollow note is obtained. When the cavities are filled with exudation

the percussion note will be dull, but after expulsion of the exudate, the tympanitic sound is again obtained. Auscultation shows no change; the normal vesicular murmur is heard in those portions of the lung free from disease; the respiratory murmur is feeble if many bronchioles are obstructed, and harsh or blowing if the bronchioles are narrowed. The crepitant rale is also heard. If bronchitis is present subcrepitant and mucous rales are also detected. When cavities form, bronchial or cavernous respiration is heard, associated with gurgling rales. If the cavity is empty, and has walls which do not collapse, the breathing is amphoric.

Tubercular Phthisis (Tuberculosis; Consumption; Chronic Phthisis)

Etiology.—As in other forms of tuberculosis, the primary cause is a low grade of resistance due to faulty innervation of the respiratory tract which is the atrium of the infection. The direct cause, when such favorable conditions obtain, is the tubercle bacillus. Contributing factors are poor hygienic surroundings, family predisposition, and exhausting diseases.

Pathology.—The bronchial glands contain numerous minute tubercles, and cheesy foci. Adhesions and thickening of the pleurae. There is often a serous, purulent, or bloody effusion. Pyopneumothorax is sometimes present. The lesions in the lungs are generally situated at the apex. Other organs, especially the larynx and intestines are often the seat of tuberculous lesions.

Symptoms.—The symptoms of early tuberculosis are slight fever every evening, increase in the pulse-rate, spitting of blood, bronchial cough, pains in the thorax, and gastric disturbances. As the disease advances, distressing cough which becomes worse, and expectoration which at first is muco-purulent and later becomes yellowish or greenish. Dyspnea becomes more marked as the destruction of lung tissue continues. The fever which at first is moderate, becomes hectic and is accompanied by chills and sweats. Chest pains are due to the associated pleurisy and violent coughing. Later still, night-sweats and hemoptysis become severe. Progressive loss in flesh and strength which is least noticeable upon the face. Insomnia, nausea and vomiting, and diarrhea.

The earliest physical signs are a slight sinking in and

failure of expansion of the upper part of the thorax; this may be so slight as to be scarcely noticeable except by comparison with the healthy side. On palpation a slight diminution of the vocal fremitus is detected. On percussion the normal vesicular resonance is diminished. On auscultation a crepitant rale is heard; if this rale is present day after day, at the same spot, for a period of two weeks, tuberculosis may be strongly suspected. These signs must be recognized, as only an early diagnosis of tuberculosis is of practical value. Later on, as consolidation of the lung becomes more marked, all the above signs are increased. Later still, when cavity formation has commenced, bubbling rales are heard, the percussion note is tympanitic, breathing is cavernous, and metallic tinkling, succussion, and cracked-pot resonance may all be present.

Fibroid Phthisis (Chronic Interstitial Pneumonia; Cirrhosis of the Lungs

Etiology.—The primary cause is faulty resistance while the secondary cause is the tubercle bacillus. Predisposing factors are occupation, heredity, and previous pulmonary diseases, and chronic wasting diseases, which by the production of reflex subluxations in the segments that control the lungs, render them liable to tuberculosis in the presence of the bacilli.

Pathology.—Marked development of fibrous tissue in addition to the tubercular process in the lung, with consequent shrinking of the affected lung.

Symptoms.—This disease commences as a bronchial catarrh, which is worse in winter and better in summer, and runs a chronic course. In the more advanced stages of this disease, the cough is more persistent and the expectoration more abundant, consisting of muco-purulent material. Later on, fever with night-sweats and dyspnea and rapid emaciation develop. Edema of the ankles is a late symptom and is due to failure of the circulation. Inspection shows the thorax retracted on the affected side. The percussion note is diminished in resonance or dull. Auscultation shows broncho-vesicular respiration, and subcrepitant, mucous and bubbling rales. Later on bronchial and cavernous breathing are heard.

Hygiene.—The patient should sleep alone, in a well-ventilated room. All articles soiled by the sputum, as bed linen, eating utensils, etc., should be disinfected. Sputum cups, which may be burned, should be used. The patient should live in the open air, in a tent. A dry, equable climate is best, as in Arizona, Colorada and New Mexico. If unable to do this, sleeping in a tent in the yard, sleeping on the porch, or with window tents, may be substituted. Daily cold sponge baths of the chest. Moderate exercise is beneficial, but should not be carried to the point of causing a rise in temperature. Hemorrhages are seldom fatal. The best routine measures are absolute rest, ice to suck, and an ice-bag on the affected side. When cough is severe enough to produce vomiting, or to disturb the sleep, inhalation of steam. Rest in bed when fever is high; if it is over 103°, cold sponging. Careful selection of the diet and regulation of the bowels. Enemata for digestive disturbances.

Adjustment.—A careful spinal analysis should be made in every case on account of the existence of complications in different organs. The 3rd thoracic vertebra is adjusted for the apex of the lungs; the 7th cervical vertebra, or the 1st and 2nd thoracic vertebra are adjusted for the catarrh of the bronchial tubes; for the lower portion of the lungs adjustments are made as far down as the 5th thoracic vertebra. Since involvement of the liver, kidneys, spleen, and gastro-intestinal system is frequent in this disease, attention should be paid to the spinal segments which control these parts of the body, and adjustments made whenever indicated. Adjustment of the coccyx, having decided effects upon the nervous system, through stimulation of the ganglion impar and upon the circulation is general, is a very good measure in all varities of tuberculosis.

Some authors claim that the persistent use of the sponge bath for two or three days, giving as high as 20 baths a day, will often do away with grave symptoms. Others advise a fast in the treatment of tuberculosis, claiming that a fast of two or three weeks enables the system to eliminate all toxic materials, and permits the nervous system to produce that measure of resistance necessary to an eradication of the disease, but the author does not share this opinion,

holding that any gain in weight is always a favorable sign in tuberculosis.

Tuberculosis of the Larynx

Etiology.—This condition is secondary to tuberculosis of the lungs, and is due to the production of reflex subluxations in the segments which govern the larynx.

Pathology.—Tubercles which undergo caseation and ulceration first appear on the mucous membrane, and then involve the cartilage. The ulcers are saucer-like, have irregular borders, and their base is gray. The process invades the surrounding tissues.

Symptoms.—The first sign is slight hoarseness. Finally all the symptoms of chronic laryngitis are present. Later on dysphagia develops.

Adjustment.—Adjust the 4th cervical and the 2nd and 5th thoracic vertebrae.

Tuberculosis of the Alimentary Tract

Tuberculosis of the lip is rare and simulates cancer. Tuberculosis of the tongue shows as ragged-edged tubercular ulcers. Tuberculosis of the tonsils appears as small tubercular ulcers. It is claimed that the tonsil is the usual point at which the bacilli enter the body. Tuberculosis of the stomach is rare. Primary tuberculosis of the intestines affects children, and the most common symptoms are distension of the abdomen, tenderness, fever, diarrhea, and emaciation. The ulcers may heal, and stricture of the bowel follow. In the secondary form, perforation and hemorrhage may occur.

Adjustment.—Adjust according to the region affected, and employ the hygienic measures mentioned under tuberculosis.

Tuberculosis of the Genito-Urinary Tract

The kidney may present all stages from miliary tubercles to complete destruction of the organ. Both kidneys are usually affected, the tubercular process being most active in the pelvis of the kidney and in the ureter. The symptoms are frequent urination, the urine containing pus and blood. Tenderness in the lumbar region. Irregular fever. Loss of weight and strength. Adjust the 10th thoracic vertebra and any other subluxations which may be found.

Tuberculosis of the ureter and bladder usually follows tuberculosis of the kidneys and the symptoms are those of an obstinate case of cystitis. Adjustment of the 10th thoracic and the 1st lumbar vertebrae should be made.

Tuberculosis of the prostate and seminal vesicles is evidenced by a rectal examination, which detects hard nodules, about one-half an inch in diameter. Adjust the 1st and 4th lumbar vertebra. Use concussion over the 12th thoracic vertebra.

Tuberculosis of the testes is characterized by pain, nodules which may be palpated, and softening of portions of the testes. Adjust the 4th lumbar vertebra. Surgical interference is sometimes necessary.

Tuberculosis of the fallopian tubes is not uncommon, but the uterus and ovaries are very rarely affected. The symptoms are those of chronic salpingitis. Adjust the 4th lumbar vertebra.

Relapsing Fever (Famine Fever, Seven-Day Fever)

Etiology.—The exciting cause is the spirillum of Obermeier. The predisposing cause is a low grade of vital resistance due to faulty innervation.

Pathology.—No characteristic lesions are present. The spleen is enlarged and softened. The liver and kidneys are congested. Catarrhal inflammation of the stomach and bile-ducts may exist.

Symptoms.—There is an incubation period of from 5 to 7 days. This is followed by a febrile paroxysm lasting about six days; the onset is sudden with pains in the back and limbs, a severe chill, and rise in temperature to 104°. An intermission of six days follows, during which the patient is in fair health. A relapse then occurs, lasting six days. Several such intervals and relapses may occur. Palpation of the vertebral column detects one or two segments which are the seat of a higher temperature than others. That segment in which the temperature is the highest is usually about the 6th and 10th thoracic vertebrae.

Adjustment.—Adjust the 6th, 8th or 10 thoracic vertebra. The patient should be isolated. Careful disinfection is necessary to prevent the spread of the disease. Rest in bed and proper diet.

Malaria (Ague; Chills and Fever)

Etiology.—This disease is seen mostly in tropical and temperate climates, and in lowlands, swamps, and the seacoast. The attacks are most common in the autumn. The predisposing cause is a subluxation of the 9th dorsal vertebra in most cases. The exciting cause is plasmodium malariae, a parasite developing in a mosquito, and which is transmitted to man, by the bite of the infected mosquitos. The parasites are of several varieties, and each causes a certain type of the disease.

Pathology.—In acute cases the red corpuscles and hemoglobin are diminished. The spleen is enlarged, soft, and congested. In pernicious types with cerebral symptoms the brain is often congested. Anemia is present in severe cases. In chronic cases the spleen is much enlarged, infiltrated with connective tissue, gray, and pigmented; its capsule is thickened. The liver is similarly affected. The kidneys are the seat of inflammatory changes.

Malaria exists in three forms: (1) Intermittent fever; (2) Remittent fever; (3) Pernicious malaria.

Intermittent Fever

This form of malaria is characterized by a chill, a hot and a sweating stage. The chill begins with malaise, headache, and nausea, followed by the chill itself, the skin becoming cold and pale. The temperature rises to 103° or 104°. This stage lasts from a half to one hour. It is followed by the hot stage in which the temperature goes to 106° or higher. The pulse is tense and rapid. The skin is hot and red. Headache, backache, and thirst are also present. The urine is scanty, high-colored, and of high specific gravity. This stage lasts from one to ten hours, and is followed gradually by the sweating stage which commences on the forehead, and extends over the entire body. As sweating becomes profuse, the symptoms subside. This stage lasts about 3 hours. An intermission, varying in length according to the nature of the malarial organism, is followed in turn by another paroxysm.

Remittent Fever (Bilious Fever)

In this type of malaria the temperature is continuously above normal with slight remissions at definite inter-

vals. There are the same stages as in the preceding form, but the cold stage is not so marked, and is sometimes entirely wanting. The temperature is very high during the hot stage, and severe headache and gastric disturbances are present. The sweating stage is not well-marked, and in many cases entirely absent. Jaundice, and enlargement of the liver and spleen occur.

Pernicious Malarial Fever (The Congestive Chill)

This type of malaria exists in three forms, namely, the algid or asthenic, the hemorrhagic, and the comatose. The algid variety commences with great prostration and persistent vomiting. Diarrhea and anuria then develop. The temperature may be subnormal. In the hemorrhagic form the characteristic sign is hemoglobinuria which is probably due to the previous excessive use of quinine. In the comatose variety, a high temperature followed by delirium or coma are the characteristic symptoms.

Adjust the 6th, 8th and 10th dorsal, and the 5th cervical vertebrae. Enemas should be given. A liquid diet is necessary during the disease.

Diphtheria

Etiology.—Irritation of the nerves supplying the air passages with a resulting weakening of the nerve-supply to the air passages, is the chief predisposing cause, as is shown by the fact that adjustment assists in stopping the progress of the disease. Diphtheria is endemic in cities and epidemic in the cold autumn months, the severity varying in different epidemics. Children from two to fifteen years of age are most susceptible. The predisposing cause is a mid-cervical subluxation; the exciting cause is the Klebs-Loeffler bacillus.

Pathology.—The affected area shows a grayish, false membrane, made up of a fibrinous exudate, and necrotic tissue.

Symptoms.—The incubation period varies from two to seven days. The invasion may be severe or mild. It is usually marked by chilliness, sometimes convulsions, pain in the back and limbs, and a temperature of 102° to 104° F.

Nasal Diphtheria.—The nasal cavities are obstructed by a gray, false membrane. The fever may not be high, but there

are great systemic disturbances. The cervical and submaxillary lymph nodes are enlarged early in the course of the disease.

Pharyngeal Diphtheria.—Dysphagia is the first sign. Fever rises rapidly to 100°-102°. Considerable systemic disturbance is early. The cervical lymph nodes may be enlarged. A false membrane, commonly situated on the tonsils, is present. When part of this membrane is removed, a bleeding surface is left. Late symptoms may be intense toxaemia, cardiac failure, and the typhoid state.

Laryngeal Diphtheria.—Often the onset is gradual and there may be no membrane in the throat, and the attendant is called in to see the case because the child, which has been sick with a "cold" for a few days, has developed a croupy cough and shortness of breath. The dyspnea, the aphonia or hoarseness and the croupy cough usually are continuous and progressive. The fever is moderate. The systemic disturbances soon become pronounced. The cervical lymph nodes are swollen. Symptoms of asphyxiation may develop.

Adjustment.—If a case of diphtheria is seen sufficiently early, and the proper adjustments are made, there will be no difficulty in checking the progress of the disease. Adjust the middle cervical vertebrae, and the 5th thoracic. Adjustment of the coccyx is often beneficial. Swabbing of the throat with a cleansing mixture is very necessary. Give the patient large amounts of hot water to drink, but no food of any kind. For nasal cases, irrigate the nose and throat with normal salt solution. For laryngeal cases, cold or hot applications to the neck and steam inhalations. For cardiac weakness, adjustment of the 7th cervical or 2nd dorsal vertebra, rest, and avoidance of all exertion.

Pellagra

Etiology.—The primary cause is faulty innervation, resulting in a low grade of vital resistance. The exciting cause is supposed to be maize; and "The morbific action of maize has been variously attributed to (a) Deficiency in its nutritive principles. (b) Specific toxic substance contained normally in the grain. (c) Poisons elaborted after it has been ingested. (d) Toxic substances elaborated during decomposition of the grain. (e) Fungi or bacteria found on maize." (Manson.)

Symptoms.—The prodromal period is characterized by malaise. The common symptoms following the onset of the disease are pain and tenderness in the epigastric region, constipation alternating with bloody diarrhea, pain in the back and extremities, and headache and vertigo. A fine rash covers the body and lasts for 2 or 3 weeks. Reflexes are exaggerated; insomnia and tremors of the tongue are present.

Adjustment.—Adjust the 6th and 10th thoracic and second lumbar vertebrae. The diet should be carefully regulated, fruits and vegetables being eaten exclusively.

CHAPTER III

Diseases Caused by Animal Parasites

Ascariasis

1. Round Worm (Ascaris Lumbricoides) is similar to the angle worm in shape, and of a light brown color. The eggs are small, oval, and brownish-red. Generally only one or two worms are present in a patient, but sometimes many are present. The upper part of the small intestine is where they are generally found, but they may enter any part of the gastro-intestinal or respiratory tract or the bile-ducts and liver. They are most common in children, and picking of the nose, grinding of the teeth, restlessness, or even convulsions are the usual symptoms. However, no signs except their presence in the stools may be noted.

2. Pin Worm (Oxyuris Vermicularis) is a worm of small size commonly seen in children. Its habitat is the lower bowel. The characteristic symptoms are violent itching about the anus, and the presence of the worms in the stools.

Adjustment.—Adjust the 11th and 12th dorsal or 1st and 2nd lumbar vertebrae.

Anchylostomiasis (Brickmaker's Anemia; Miner's Cachexia)

Etiology.—Caused by the anchylostorum duodenale, a small worm which is present in the small intestine, attaching itself to the mucous membrane by its hooks, and which lives by sucking blood. The characteristic symptom is the presence of the eggs in the stools.

Adjustment.—The stools should be disposed of and drinking water boiled. Adjust the 11th and 12th dorsal and 1st and 2nd lumbar vertebrae.

Echinococcus Disease (Hydatid Disease)

Etiology.—The echinococci are the larvae or embryos of the taenia echinococcus from the dog.

Pathology.—The echinococcus cyst may be found in the liver, lung, spleen, kidney and other organs. The embryo

originally has six hooks. When the cyst begins to form, the hooklets disappear. The cyst fills with clear fluid. From the inner of the two layers of the parent cyst, multiple daughter cysts form. These become free from the mother cyst, and from the inner layer of the daughter cysts, buds may form granddaughter cysts. Within the cysts scolices are formed which are the heads of new taeniae and are made up of four sucking discs and four hooklets. In time the cyst may undergo inspissation, suppuration, or rupture. Rarely in the liver, the cyst is multilocular and the fluid gelatinous,—the Multilocular Echinococcus.

Symptoms.—In the liver, the symptoms are those of tumor; increase of liver dullness; rarely fluctuation; a soft elastic tumor; and mild or no subjective symptoms. In the pleura, the signs are those of pleurisy with effusion. In the lung, it generally results in abscess or gangrene, and the diagnosis is made by finding the hooklets in the sputum. In the kidney the condition may be latent or resemble a hydronephrosis. In the nervous system the cyst is usually located in the cerebrum and resembles brain tumor.

Adjustment.—Make adjustments according to the location of the disease. Surgical measures are sometimes necessary.

Filariasis

Definition.—The most common species is the Filaria of Bancroft. The eggs are present in the blood stream while the adult worms are found in the lymphatics.

Symptoms.—"Filariae may cause no symptoms. If the adult worms or ova block lymph channels they cause hematochyluria, lymph scrotum, elephantiasis, etc. (1) HEMATOCHYLURIA: The only symptom is the passage at intervals of milky, bloody, or chylous urine, which deposits a reddish sediment. It contains minute fat drops, usually red cells, and sometimes the embryos. The passage of blood clots from the bladder may cause pain. (2) LYMPH SCROTUM: The scrotal tissue is much thickened, and enlarged lymphatics are seen." (Dayton.)

Adjustment.—Boil the drinking water. A careful spinal analysis should be made and adjustments made accordingly. The prognosis is however unfavorable.

Tapeworms

The pork tapeworm is six to twelve feet long. It has a round head smaller that that of a pin, with a projection, on which is placed a double ring of small hooks and below which are four sucking disks. By means of these hooks and disks the worm attaches itself to the lining of the small intestine of man. Below the head is the neck, which is succeeded by a large number of segments, increasing in size from the neck down. Each segment contains the generative organs of both sexes. The parasite is fully developed in three months. Segments then continually break off and are discharged at stool. When swallowed by a pig or man the shells containing the embryo worms are digested and the embryos wander to various parts of the body, where they change to "measles." Each of these contains a tapeworm head. When meat containing "measles" and which is only partly cooked is eaten, the cyst is dissolved in the human stomach and the freed head attaches itself to the lining of the intestine, and develops into a tapeworm. The beef tapeworm, is the common form in this country. It is larger than the preceding, being fifteen to twenty feet long, has larger segments than the pork tapeworm, and a large head, which possesses no hooklets, but is square and has four sucking disks.

Symptoms.—These are often absent. In some cases, colicky pains, excessive appetite, indigestion, emaciation, constipation, palpitation of the heart, faintness, spasms, anemia and itching of the nose and anal region are present. The ingestion of a large meal often removes most of these symptoms. The finding of one or more segments of the tapeworm in the stools is diagnostic.

Adjustment.—Some Chiropractors claim to be able to cause the removal of tapeworms by spinal adjustment. They base this view on the opinion that tapeworms as well as other animal parasites are simply scavengers in the gastro-intestinal tract. This view is, however, incorrect, since the presence of tapeworm in the intestine is due solely to the fact that the patient has eaten meat which contains the eggs. Under normal conditions a sufficient degree of acidity is probably present to destroy these eggs, and if the gastro-intestinal tract is in such a normal condition, these eggs may be ingested and destroyed. However, there is not

enough acid in the stomach to destroy a tapeworm. In the author's opinion, fasting and giving a vermifuge are the only logical methods of disposing of a tapeworm. Adjustment of the 5th and 8th thoracic vertebrae may be given for their influence on the secretion of the digestive fluids. The 12th thoracic, and the 2nd lumbar vertebrae may also be adjusted for their influence on the large intestine.

Trichinosis

Etiology.—The trichina spiralis, which lives in the small intestine, and the embryos of which migrate to the muscles.

Symptoms.—A week or two after eating the measled pork, the symptoms begin with a chill and high fever, severe pains and stiffness in the muscles, gastro-intestinal disturbances, edema, and rapid loss of flesh and strength. The stools should be examined.

Adjustment.—Adjust the lower dorsal and upper lumbar vertebrae. Enemas, especially in the early stages, when the parasites are present in the stools. Symptomatic adjustments whenever indicated.

CHAPTER IV

The Intoxications and Sunstroke

Alcoholism

Etiology.—Acute Alcoholism, as its name implies, is due to the consumption of a large amount of alcohol, during a brief period. Chronic Alcoholism is due to the continuous excessive use of alcohol.

The following symptoms are characteristic of this state: Full pulse; flushed face. The mental faculties are first stimulated, then blunted. There is loss of co-ordination shown by unsteady gait, then relaxation of the muscles, and finally unconsciousness and puffy breathing. Pupils are contracted or dilated, and if the face is struck, dilatation is produced. Temperature is subnormal; reflexes and sensation are decreased.

The common symptoms of chronic alcoholism are tremor of the hands, chronic gastritis, atrophic cirrhosis of the liver, hardening of the arteries, neuritis and fatty degeneration of the heart.

The symptoms of delirium tremens are first insomnia, restlessness and depression. Delirium accompanied by loud talking, and hallucinations then develop and the patient imagines he sees various things and hears different sounds, and becomes violent. There is marked insomnia. The tongue is heavily coated. This condition continues for several days, at the end of which time restoration of mental and physical faculties takes place.

Adjustment.—Acute alcoholism: Gastric lavage, adjustment of the atlas, fifth and tenth dorsals, and a cold bath. Chronic alcoholism: Confinement in a sanitarium and adjustment of the atlas, fifth and tenth dorsals. Complete withdrawal of alcohol, and nourishing diet. Delirium tremens: Do not forcibly restrain the patient, but confine him, and constantly watch him to prevent self injury. Alcohol should be entirely withdrawn.

Morphine Habit

Etiology.—The morphine habit is usually acquired by repeated use of the drug for pain.

Symptoms.—These include constipation, a yellowish complexion, tremors, insomnia, and mental unrest and impairment. When the drug is withheld from the patient, he suffers extremely; a general feeling of unrest, anorexia, nausea, diarrhea, neuralgic pains, and ringing of the ears are the chief symptoms present.

Adjustment.—If the case has not progressed too far, general adjustment, a wholesome environment, followed by a balanced diet, will produce satisfactory results. The fact, however, must not be lost sight of, that some underlying ailment very likely induced morphinism in the first place. See to it that such conditions are removed. Adjust the atlas and the 5th thoracic vertebrae.

Cocaine Habit

Symptoms.—The drug is taken as snuff, in sprays, or hypodermically. Large doses cause great mental excitement, and occasionally convulsions. This is followed by cardiac and respiratory weakness, prostration and coma. The cocaine habit causes digestive disorders, loss of flesh and strength, disordered heart action, mental impairment, nervousness, and moral depravity.

Adjustment.—Same as for morphine habit.

Chloral Habit

Symptoms.—There is first exhilaration, which is followed by mental and physical depression, foul breath, spongy gums, anorexia, indigestion, emaciation, permanent dilatation of cutaneous blood vessels, intermittent pulse, irritability, insomnia, sensory and motor disturbances, and impairment of mentality.

Adjustment.—Same as for morphine habit.

Lead Poisoning

Etiology.—Those engaged in occupations which involve the handling of lead, such as painters, plumbers, and printers, are very liable to contract lead poisoning if the innervation of the eliminating organs is below par.

Symptoms.—The characteristic symptoms and signs are lead colic, retracted abdomen, constipation, a blue line on the gums, wrist drop, headache, tremors, anemia, pains in the joints. Common sequels are wrist drop, arteriosclerosis, nephritis, and optic atrophy.

Adjustment.—Remove the cause. Adjust the 5th and 10th dorsal and 2nd lumbar vertebrae.

Arsenic Poisoning

Etiology.—Arsenical poisoning can be contracted from arsenical paint, wall paper, and any material containing arsenic with which persons are brought into close daily contact when the organs of elimination are not receiving their full quota of nerve-supply to enable them to function effectively.

Pathology.—Gastro-enteritis, fatty degeneration of liver, spleen, and kidneys, peripheral neuritis. Arsenic is present in tissues.

Symptoms.—The characteristic signs and symptoms of this form of intoxication are edema of the eyelids, dryness of the throat, gastro-intestinal disturbances, eruptions and pigmentation of the skin. Paralysis of extremities, especially the legs, with atrophy and numbness, but little pain.

Adjustment.—Remove the cause. Adjustment is the same as for lead poisoning, except that adjustment will be most necessary in the 5th and 7th thoracic segments.

Food Poisons

Etiology.—This includes poisoning by spoiled meats, fish and oysters, candies, soups, canned foods, cheese and ice cream.

Symptoms.—Acute gastro-enteritis, with intense prostration terminating in collapse.

Adjustment.—Empty the stomach by giving a solution of soda in tepid water to induce vomiting. Give a high enema. Stimulants such as black coffee may be necessary. Adjust the 5th, 6th, or 7th and lower dorsal vertebra, and the 1st or 2nd lumbar vertebra.

Sunstroke

Symptoms.—In severe cases, where exposed to intense heat, the patient falls unconscious, and death occurs almost

immediately or after a few hours, from coma, and failure of the heart and respiration. In the usual cases there is sudden arrest of perspiration, headache, vertigo, nausea and vomiting; failing vision, then unconsciousness, which may be temporary or pass into coma. The face is flushed, skin dry and hot, pupils dilate for a time, then usually greatly contracted; muscular relaxation or spasms; fever is 107° to 110° or even higher; pulse high tension and rapid; respirations deep and labored or snoring. In fatal cases, coma deepens, the pulse becomes weak and rapid, respiration irregular, shallow, and rapid, or of Cheyne-Stokes type, and death occurs in twenty-four to thirty-six hours. In others, consciousness returns, temperature falls, pulse and respiration become normal, and recovery with sequelae occurs. Prominent among the sequels are physical weakness, impaired memory or power of concentration, or headache and mental disturbance whenever the weather is warm.

Adjustment.—Adjust the 1st and 4th cervical and the 10th dorsal vertebrae. For mild cases rest in a cool place, cold sponging, and stimulants. For severe cases immediate bathing in ice water, with friction, and ice water enemas. If ice cannot be obtained, strip and sprinkle with water until temperature is reduced. Gastric lavage, especially if alcoholic. Subsequently cold sponging if needed.

CHAPTER V

Constitutional Diseases

Chronic Articular Rheumatism

Etiology.—The cause of this disease is faulty innervation of the joints, as a result of reflex subluxations produced during the course of acute rheumatism and superinduced by exposure to cold and wet.

Pathology.—The capsule of the joint, together with its ligaments and surrounding tissue is thickened.

Symptoms.—The affected joints are stiff and painful during damp weather. The movement of the affected joints becomes more and more impaired, and the joints distorted, as the disease continues. No severe constitutional disturbances are present in uncomplicated cases. Usually a number of joints are affected.

Adjustment.—Make adjustments in those segments which control the parts affected; also adjust the 6th and 10th thoracic vertebrae. The diet should be free from meat, and only fruits and vegetables should be used.

Muscular Rheumatism

Etiology.—This condition is caused by faulty innervation which is produced through a draught of cold air striking a part of the body the afferent impulses from which reflexly produce vertebral subluxations.

Symptoms.—An acute attack usually occurs, and is marked by a sudden onset, and pain, soreness and rigidity of the affected muscles, increased by motion. There is no rise in temperature. The duration is about one week, and develops frequently into the chronic form, which is marked by acute exacerbations during changes in the weather.

The disease may affect all or some of the voluntary muscles, but its most frequent and important varieties are: "1. CEPHALODYNIA—Situated in the occipito-frontalis muscle. It is distinguished from neuralgia of the trifacial or occipital nerve, by pain on both sides of the head, excited

or aggravated by the movements of the muscles and by absence of disseminated points of tenderness. The muscles of the eye may be affected, and movements of that organ excite pain. If the temporal and masseter muscles are attacked, mastication induces pain. 2. TORTICOLLIS—Wry neck, or stiff neck. Situated in the sternomastoid muscles. Generally limited to one side of the neck, toward which side the head is twisted, great pain being excited on attempting to turn to the opposite side. Rheumatism of the muscles of the back of the neck, cervicodynia, may be mistaken for occipital neuralgia. 3. PLEURODYNIA—Situated in the thoracic muscles and may be mistaken for pleuritis, or intercostal neuralgia from which it is differentiated by the absence of the diagnostic features of each. Pain is excited by forced breathing, coughing and sneezing. 4. LUMBAGO or LUMBODYNIA—Situated in the mass of muscles and fasciae which occupy the lumbar region. This is the most common variety; and usually affects both sides. It may set in rapidly, and become very severe. Motion of any kind aggravates the pain, which often becomes very sharp or stabbing in character. It is sometimes complicated with acute sciatica, when the suffering is agonizing." (Hughes.)

Adjustment.—Rest is very essential and is accomplished in pleurodynia by firmly strapping the side which is affected with broad strips of adhesive, extending from the spine to the middle of the sternum. This limits the respiratory movements on the affected side and gives the patient comfort and relief from pain until the condition is relieved by adjustment. The bowels should be kept regular. Make adjustments according to the location of the disease. The diet should consist principally of fruits and vegetables.

Arthritis Deformans (Rheumatoid Arthritis)

Etiology.—The primary cause is disturbed innervation of the affected parts. Predisposing causes are mental worry. The disease is most common in women.

Pathology.—The cartilage of the joint first becomes thickened. This is followed by degeneration and absorption, the bone end being left bare, and becoming smooth and ivorylike. The synovial membrane thickens, and in some

places is converted into bone. The muscles surrounding the joint become shrunken.

Symptoms.—Several distinct types exist. (1) General Progressive type: (a) Acute: Usually in women of twenty to thirty years or at the menopause. Invasion like acute articular rheumatism, many joints, permanent enlargement appearing early, rarely redness of joints, pain very severe, moderate rise of temperature, malaise, anemia, loss of flesh and strength. The first and later attacks are often associated with pregnancy, labor or lactation. (b) Chronic: Gradual onset of pain or stiffness in one or more joints, usually of the fingers, then of corresponding joints of the other side, then of others. Involvement symmetrical. Swelling at first may be in its soft parts, with joint effusion and tenderness. Pain may be slight or severe. Periods of improvement and exacerbation alternate, the joints becoming enlarged and deformed, often incompletely ankylosed in partial flexion by thickening of bone and soft parts; joints crepitus. The muscles moving them atrophy and there may be trophic changes in the skin and nails of the extremities affected. Digestive disturbances and anemia are common. Heart not affected. A few joints only may be attacked or many, with great deformity, before the disease reaches a period of inactivity. (2) Monarticular type: Usually in males over fifty years, one joint or a few large joints may be affected, generally with atrophy of corresponding muscles. In the case of the hip this is called morbus coxae senilis. (3) Heberden's nodes: Common in women between thirty and forty years. Often preceded by digestive disturbances. With occasional attacks of local pain and swelling, or insidiously, small hard tubercles form at the sides of the dorsal surface of the extremity of the second phalanges. The presence of these nodes may be the only sign of the disease. (Dayton.)

Adjustment.—The chief indications are to relieve the pain and improve the general condition of the patient. This is best accomplished by having him live in a warm, dry climate, and lead a hygienic life, eating substances of the most nutritious character. Make specific adjustments according to the region involved.

Gout

Etiology.—The primary cause is faulty innervation, in the presence of which a deficient amount of exercise, and the ingestion of too much food, act as the chief contributing factors.

Pathology.—The blood contains an excessive amount of uric acid, and sodium urate is deposited in and about the joints.

Symptoms.—Preceding an acute attack of gout there are malaise, depression and headache. The attack comes on in the early hours of the morning, and disappears toward the latter part of the day, to recur the following night. There is agonizing pain in the affected joint, which is usually the great toe; the joint is hot, swollen, and of a dark red color. There is a slight rise in temperature. The urine is reddish, and on standing, a sediment of urates appears. An acute attack of this kind lasts a week or ten days, and a number of such attacks finally merge into the chronic form. In this variety the phalangeal joints become distorted by the deposition of urates about them. Gastric disturbances and arteriosclerosis are present.

Adjustment.—Adjust the 1st cervical, 5th and 10th thoracic, and the 5th lumbar vertebrae. The diet should consist principally of fruits and vegetables.

Rickets

Etiology.—The prime cause is malnutrition and unhygienic surroundings, and a number of its later manifestations are a result of the consequent disturbance of the nerve supply to various parts of the body.

Pathology.—The bones of the skull, the long bones, and the ribs show the most pronounced morbid changes. Enlargement of the parietal and frontal eminences and flattening of the top and back of the head give it a square outline. The fontanels do not close until the second or third year. The long bones are deficient in lime salts, and consequently become soft and bend easily, producing deformities such as bow-legs and curvature of the spine. The sternal ends of the ribs become enlarged and nodular, and these rows of nodules on each side have a beaded appearance and are termed the rachitic rosary.

Symptoms.—The characteristic symptoms of rickets are disturbed sleep, with profuse perspiration of the head, general tenderness, abdominal distension, nausea and vomiting, nervousness, and convulsions. Teething is delayed; the teeth are poorly formed. There is severe muscular asthenia, which prevents the child from sitting erect or walking.

Adjustment.—Adjust the 5th, 8th and 10th thoracic vertebrae, and any other subluxation which may be present. The first indications are to provide hygienic surroundings and proper food for the child. If the child is nursing and the mother's milk is poor, cow's milk should be substituted and properly modified to suit the individual requirements. Older children should be given beef-juice and eggs, in addition to milk. Starches and sugars should be avoided. Orange and lemon juice are beneficial in many cases. Thin gruels may be given.

Scurvy

Etiology.—Lack of fresh fruit and vegetables in the diet, and unhygienic surroundings in individuals whose vital resistance is reduced by deficient innervation.

Pathology.—The walls of the blood-vessels are changed, permitting spontaneous hemorrhages to occur into the skin, mucous membranes, viscera and muscles and joints. The blood is dark in color and thin, and anemia is present. Parenchymatous degeneration of the spleen, liver and kidneys occurs. The gums are swollen and ulcerated and the teeth often fall out. Ulcers of the ileum and colon may be encountered.

Symptoms.—The disease commences gradually, the first symptoms being weakness, loss of weight, and anemia. Hemorrhages next occur in various parts of the body, especially the skin and mucous membranes. As a result of the ulceration of the gums, the breath is fetid. Systemic disturbances are marked. Palpitation of the heart and edema of the ankles are present.

Adjustment.—Adjust the 4th cervical and 5th thoracic vertebrae. The diet should consist of vegetables and fruits. Attend to the hygiene.

Hemophilia

Etiology.—This disease is hereditary, and is transmitted by the mother to her male offspring. Fathers, however,

transmit to their daughters who are exempt, the male subjects usually being affected by the disease.

Symptoms.—The characteristic feature of this condition is the tendency to severe hemorrhages following slight injuries. Frequently such hemorrhages occur spontaneously and without any apparent cause. Subcutaneous hemorrhages are common, although bleeding from the nose and mouth is seen in most cases. The blood coagulates very slowly.

Adjustment.—Make adjustments according to the seat of the hemorrhage and of the 7th and 8th dorsals for the blood-forming organs. Individuals subject to this disease should guard themselves against the possibility of injury.

Diabetes Mellitus

Etiology.—Pancreatic disease due to interference with the nerve supply of that organ. The disease is seen most commonly in adult males, and contributing causes are overwork, cerebral or spinal injuries and diseases, infectious diseases, and obesity.

Pathology.—In one-half the cases lesions of the pancreas are present. Sometimes the nervous system is the seat of morbid changes, while in some cases no pathological changes at all exist.

Symptoms.—There is loss of flesh and strength. Increased thirst and appetite. The urine is increased in quantity, of a high specific gravity, and a pale color; it has a sweetish odor; it contains varying amounts of sugar, and often albumin, acetone, and diacetic acid. Other secretions are diminished, causing dryness of the skin and mouth, and constipation. The temperature is subnormal. Coma frequently develops.

Boils and carbuncles, eczema, pneumonia, tuberculosis, arteriosclerosis, neuritis, herpes zoster, perforating ulcer of the foot, sterility, cataract, optic atrophy, retinitis, and diabetic coma are the most common complications.

Adjustment.—Adjust the 1st cervical and the 4th and 8th thoracic vertebrae. The diet should be so regulated as to exclude or at least to reduce to a minimum the quantity of starches and sugars until the organs are again able to carry out their functions, as a result of adjustments. Fresh

air, daily bathing, and regular exercise are essential factors to be followed. The rooms occupied by the patient should be well ventilated. Exercises should be taken daily, according to the patient's strength, care being taken to prevent over-exertion. Flannel underclothing should be continuously worn.

Diabetes Insipidus

Etiology.—The primary cause of the excessive secretion of urine consists in dilatation of the renal vessels, the result of paralysis of their muscular coat, caused by derangement of innervation, since the condition can be induced experimentally by irritating a certain area in the fourth ventricle, or by section of portions of the autonomic nerve. The affection is seen in persons under the age of twenty-five years. Contributing causes may be various injuries or diseases of the nervous system in addition to pressure by subluxated vertebrae, hysteria, prolonged debility, exhaustion, syphilis, malaria, and intense mental emotions.

Symptoms.—The characteristic signs of this disease are intense thirst and secretion of very large amounts of clear urine with very low specific gravity (1002-1006) and containing no sugar or albumin.

Adjustment.—Adjust the 1st cervical and 8th thoracic vertebrae. Withdrawal of fluids has no effect on the progress of the disease. Constipation should be avoided by adjusting the 2nd lumbar vertebra. Warm clothing, fresh air, exercise and so forth, are useful accessory measures.

Obesity

Etiology.—Disturbed metabolism due to interference with power of conduction of the nerves which govern the metabolic processes in the organism. Excessive development of fat may be hereditary. It occurs most commonly in middle-aged persons, sometimes in children. Its chief contributing causes are excessive eating and drinking, especially fats and starches, together with deficient exercise.

Symptoms.—The fat is increased in all places in which it is found normally, and the heart and liver are often the seat of fatty infiltration. The general health may be good, or there may be mental and bodily inactivity, indigestion, and

is greatly decreased. The replacement of the heart muscle symptoms of fatty heart. The power of resistance to disease by fat may induce dilation of that organ, and result in sudden death.

Adjustment.—Adjust the 6th and 10th dorsal vertebrae. When there is an accumulation of fat in a certain portion of the body, the vertebrae of those spinal segments which supply the affected parts should also be adjusted. Beyond this the management is chiefly dietetic. Excess of all kinds of food and drink should be avoided, especially starches and sugar. The patient should take systematic exercises daily.

CHAPTER VI

Diseases of the Respiratory System

Diseases of the Nasal Passages

Acute Nasal Catarrh (Coryza: "Cold in the Head")

Etiology.—This disease is caused by subluxations, which reduce the vital resistance of the mucous membrane lining the nasal cavities. Atmospheric changes, exposure of the neck to a draught of cold air, or of the ankles to cold and dampness, changing from a warm to a cold atmosphere suddenly, inhalation of irritant gases and vapors, dust, and powders, such as ipecac and tobacco, irritate the mucous membrane of the nose and produce reflexly subluxations in the middle cervical region. These lesions produce an impingement of the nerves to the mucous lining of the nose and congestion and increased secretion follow the irritation of the nerves. Acute coryza is often present in the initial stage of the infectious fevers, such as measles, influenza, and erysipelas. Syphilis, and potassium iodid in large doses, may at times produce it. Occasionally the affection seems contagious.

Pathology.—There is an inflammation of the nasal mucous membrane.

Symptoms.—The onset is sudden, with chilly sensations and sneezing. A slight rise in temperature follows, together with a mucous or muco-purulent discharge from the nose; a mild degree of prostration is present. Herpes on the lips are frequent.

Adjustment.—Adjust the middle cervical vertebrae, especially the 4th. Harden the body against cold and climatic changes by taking cold plunges often. Sleep with the window open.

Chronic Nasal Catarrh

Symptoms.—In the simple form there is an obstruction of one or both nostrils, and the mucous membrane is congested and turgid. In the hypertrophic form, the same symptoms are present in a greater degree. In the atrophic

form, large dry crusts are present in the nose. There is an exceedingly offensive odor, and anosmia.

Adjustment.—Adjust the 4th cervical and 5th thoracic vertebrae. Wherever possible, the patient should live in a warm equable climate. Hygienic measures, as cold plunges and exercise in the fresh air, are valuable measures.

Diseases of the Larynx

Acute Catarrhal Laryngitis ("Sore Throat")

Etiology.—When the condition of the larynx is a result of faulty innervation, it is very susceptible to inflammatory changes when influenced by the contributing causes. These are especially exposure to cold and irritating gases, excessive use of the voice and complicating la grippe and measles.

Symptoms.—There is a slight fever and systemic disturbances. Hoarseness, aphonia, a brassy cough, and dyspnea. The disease lasts from a few days to two weeks.

Pathology.—The mucous lining of the larynx is congested and swollen, and its secretion greatly decreased in amount. Sometimes only sections of the mucous membrane are affected. Later the secretion is markedly increased.

Adjustment.—Adjust the 4th cervical and the 5th dorsal vertebrae. In aggravated cases the patient should go to bed and refrain from using the voice. Cold compresses should be applied.

Chronic Laryngitis

Etiology.—Follows acute attacks as a result of the production of reflex spinal lesions which interfere with the innervation and consequent integrity of the larynx. Contributing causes are inhalation of irritating gases and constant use of the voice.

Pathology.—The larynx is congested, and there is more or less thickening and relaxation of the vocal cords. Surface erosions, and small outgrowths on the cords may be observed.

Symptoms.—The characteristic symptoms are a cough, with very little expectoration, hoarseness and pain when using the voice. There may be complete loss of the voice.

Adjustment.—Adjust the 4th cervical and 5th dorsal vertebrae. A change of climate is sometimes advisable.

Edematous Laryngitis

Etiology.—The primary cause is the same as that of simple laryngitis. The contributing causes, however, modify the course of the disease. These are syphilis, tuberculosis, infectious diseases, and retro-pharyngeal abscess. It is also present when edema from heart or kidney diseases is present in other parts of the body.

Pathology.—The mucous membrane of the glottis is edematous.

Symptoms.—Dyspnea ending in symptoms of asphyxia, a dry cough, aphonia and stridulous breathing. The epiglottis may be so swollen that it is palpable. Expiration is difficult, the lower ribs are contracted, and the abdomen is retracted.

Adjustment.—Adjust the 4th cervical and the 5th dorsal. In many cases only surgical treatment will relieve the condition.

Spasmodic Laryngitis (Croup)

Etiology.—This disease is seen in children between the ages of one and six years, and is predisposed by enlarged tonsils, adenoids, rickets and faulty nutrition.

Symptoms.—The attack comes on suddenly, during the night, with a dry, brassy cough and suffocation. In about an hour the spasm disappears, breathing becomes normal the cough less harsh, profuse perspiration occurs, and the child falls asleep again. If the case remains untreated the same thing occurs the next night, and less severely the next, after which there is recovery.

Adjustment.—Adjust the 4th cervical and the 5th dorsal vertebrae. Cold sponging is advisable in severe cases. During the attack, the spasm may be relieved by dashing cold water on the abdomen. Regulate the bowels by adjustment, and attend to the diet.

Tonsillitis

Etiology.—Tonsillitis occurs in four forms: 1. Simple acute tonsillitis. 2. Follicular tonsillitis. 3. Quinsy. 4. Chronic tonsillitis. Simple acute tonsillitis and follicular tonsillitis are seen most commonly during youth, and are primarily due to a subluxation in the middle cervical region,

which interferes with the innervation to the tonsils and renders them susceptible to inflammatory processes when the contributing causes are present. These are most commonly sudden changes in temperature, and exposure to cold and wet. If an infective process is present the previous lack of resistance due to faulty innervation renders the tonsil susceptible to the invasion of pus-forming organisms and quinsy results. The chronic form of tonsillitis is due to repeated attacks of the acute form owing to the progressively diminished resistance of the tonsils.

Pathology.—In simple acute tonsillitis the inflammatory process is limited chiefly to the mucous membrane of the tonsil. The organ is enlarged and congested. In follicular tonsillitis there is marked desquamation of the epithelium, which collects in the crypts, and there undergoes necrosis, forming small, cheesy masses, having a fetid odor. In quinsy the parenchymatous portion of the gland is principally involved. Necrosis takes place and an abscess forms. In chronic tonsillitis there is hypertrophy of the entire organ. The tonsil has undergone extensive changes, being converted into a mass of fibrous tissue acting as a foreign body in the throat.

Symptoms.—In simple acute tonsillitis the characteristic symptoms are: sudden onset, with chills and general aching of the body; rapid rise in temperature to 103° or 104° F.; the throat is hot and dry, and dysphagia is present. In the follicular tonsillitis the general symptoms are similar. The tonsils are enlarged and red and the crypts are filled with cheesy necrotic matter, showing as white spots on the tonsils.

In quinsy the tonsil is extremely sensitive, and the pain is of a throbbing nature. There is great rigidity of the muscles of the neck and the face and the mouth is opened with difficulty. A fluctuating enlargement may be palpated. There are alternating chills and fever.

In chronic tonsillitis the organs are permanently enlarged, giving the voice a nasal tone, causing mouth breathing, snoring, and regurgitation of foods through the nose. Partial deafness from inflammation of the Eustachian tube and middle ear may develop. There are recurrent attacks of acute tonsillitis.

Adjustment.—For acute tonsillitis adjust the 4th cervical and the 6th and 10 dorsal vertebrae. Cold compresses should first be applied to the neck. Later hot compresses may be substituted. The diet should be liquid.

In quinsy hot applications should be applied to the throat. If an abscess forms, surgical measures are necessary, though in some cases early adjustment and constant application of hot compresses may abort it.

In chronic tonsillitis much has been accomplished by spinal adjustment and attention to the general health of the patient, supplemented by massage. In some instances, however, surgical measures are required.

Diseases of the Bronchial Tubes

Acute Bronchitis

Etiology.—Faulty innervation will produce a lack of tone in the bronchial mucous membrane, predisposing it to inflammation as a result of exposure to colds. It is associated with nearly all lung diseases, and with many acute infectious diseases, especially measles, whooping-cough, la grippe and typhoid fever.

Pathology.—The mucous lining of the bronchial tubes is swollen and congested. The epithelium peels off, and the bronchi contain a greater or less amount of mucous or mucopurulent material.

Symptoms.—There is a heavy feeling in the thorax, beneath the sternum, pains in the back, and chilly sensations. Other symptoms which then follow are a dry cough and mild fever. There is later on expectoration of mucous or mucopus, the cough continues, but other symptoms gradually disappear. The characteristic physical signs are sibilant and sonorous rales in the early stage; later the rales become moist, namely subcrepitant and mucous.

Adjustment.—Adjust the 6th and 7th cervicals and the 1st or 2nd and 4th dorsal vertebrae. Useful measures are a hot foot-bath and a hot drink at the onset.

Chronic Bronchitis

Etiology.—Chronic bronchitis follows repeated acute attacks, as a result of the impaired resistance of the bronchial mucous membrane; during acute attacks reflex subluxations

are produced, and the innervation of the bronchi is deficient, thus permitting morbid changes to occur. Contributing causes are exposure to cold and wet; it also accompanies chronic heart, lung and kidney affections, and frequently is connected with gout.

Symptoms.—These vary greatly and may be evident only during the winter months. Characteristic symptoms are cough, worse at night or in the morning, profuse, mucopurulent, or purulent sputum, dyspnea on exertion and slight fever. The characteristic physical signs are sibilant and sonorous rales, subcrepitant rales, and evidences of emphysema.

Adjustment.—Adjust the 6th or 7th cervical and the upper dorsal vertebrae, especially the 1st or 2nd. Patients should live in a dry, warm climate if possible. Woolen underclothing should be worn in cold and changeable weather.

Hay Fever

Etiology.—This disease is due primarily to a hypersensitive condition of the Schneiderian membrane of the nose, as a result of interference with the innervation thereof. Predisposing causes are a nervous temperament and nasal abnormalities. Certain stimuli, as odor of hay, pollen of plants, and dust are the exciting causes.

Symptoms.—The leading symptoms are coryza, a wheezy cough, dyspnea, depression. It occurs at a particular season each year.

Adjustment.—Adjust the 4th cervical and the 1st or 2nd dorsal vertebrae. Correct any nasal abnormalities which may be present. Regulate the diet. Exercise in the fresh air. Each case should be handled on its own merits, since what will apply in one individual will fail in another.

Asthma

Etiology.—The primary cause is irritability of the nerves of the bronchial tubes, resulting in hyperthesia and spasmodic contractions thereof. Contributing causes are a nervous temperament, climate, heredity, and, reflexly, diseases of the gastro-intestinal or the genito-urinary system.

Symptoms.—A paroxysm usually commences in the night, with marked dyspnea, which is expiratory, the pa-

tient being compelled to sit up leaning forward. There is a sense of oppression in the chest, together with a feeling of suffocation and the face is pale. In aggravated cases the pulse is thready and rapid, the extremities are cold, and the body is covered with a profuse perspiration. Between these attacks there is more or less cough, and expectoration of stringy, viscid mucous.

Adjustment.—Adjust the 2nd or 3rd dorsal vertebrae in bronchial asthma. In cardiac asthma adjust the 2nd dorsal vertebra. For neurotic asthma adjust the 6th dorsal vertebra. For renal asthma adjust the 10th dorsal vertebra. For symptomatic asthma, adjust as indicated by a causative factor. Interference with the ganglion impar often is a cause for the persistance of asthma, and in such cases coccygeal adjustment is very good. Remove the cause if possible. A great factor in the management of these cases is a change of climate. The evening meal should be light. Hygienic measures must not be lost sight of.

Diseases of the Lungs

Congestion of the Lungs

Pulmonary congestion may be either active or passive. Active congestion is the first stage of lobar pneumonia, and is also produced by the inhalation of irritant gases and dust particles, and by closure of the vessels of other portions of the lungs.

Passive congestion is of two kinds: Mechanical and hypostatic.

1. Mechanical Congestion:

Etiology.—This is due to interference with the return flow of the blood to the heart, as in valvular disease, dilatation, or pressure on the vessels.

Symptoms.—While the heart is perfectly compensating no symptoms are present. If compensation fails, dyspnea, cough and expectoration occur.

2. Hypostatic Congestion:

Etiology.—The common cause of this form of congestion is lying in the dorsal position for a long time. It also accompanies prolonged fevers and chronic diseases.

Symptoms.—The characteristic symptoms and signs are dyspnea, cough, haemoptysis, dullness or percussion over the

lower part of thorax, subscrepitant and mucous rales, and bronchial breathing.

Adjustment.—This consists in determining the exact cause of the condition, and employing adjustments of vertebrae directed toward the relief thereof.

Pulmonary Edema

Etiology.—Pulmonary edema is the result of stasis of the blood, due to the outflow of venous blood in the lung meeting an obstacle that cannot be overcome by the right ventricle of the heart. This condition is seen in failing compensation of the heart, alcoholism, and nephritis.

Symptoms.—The condition may appear suddenly or the onset may be gradual. Characteristic symptoms are dyspnea, cough, expectoration of frothy blood-stained sputum, loud mucous rales, slight dullness at base of thorax, rise in temperature and cyanosis.

Adjustment.—Adjust the 4th cervical and 3rd dorsal vertebrae; also the 10th dorsal.

Pulmonary Hemorrhage

Etiology.—Hemoptysis is a symptom rather than a disease entity, and is seen in tuberculosis, pneumonia, and other lung affections. It is also met with in infectious fevers, hemophilia, purpura, and heart and liver diseases.

Symptoms.—The expectoration of blood is accompanied by coughing, and the blood is bright red and frothy. Mucous and subcrepitant rales are heard. There is sometimes severe pain beneath the sternum, and dyspnea may become marked.

Adjustment.—Adjust the 4th cervical and 3rd dorsal vertebrae. Complete rest is indicated, and cold compresses, preferably an ice-bag, should be applied to the chest.

Bronchopneumonia

Etiology.—Bronchopneumonia is nearly always secondary to some other diseases as a complication of measles, scarlet fever, whooping cough, influenza, diphtheria, and bronchitis. It may also complicate Bright's disease, valvular diseases of the heart, and all infectious fevers. It may also be produced by drawing food particles into the lung, or by inhalation of dust.

Symptoms.—The characteristic symptoms and signs of this disease are a sudden rise of temperature in the course of a pre-existing affection, together with dyspnea, increased pulse and respiration rate, and cough. There is an expression of great anxiety on the face. Cyanosis may develop. On auscultation both dry and moist rales are heard, especially over the back.

Adjustment.—Adjust the 4th cervical and the 2nd or 3rd dorsal vertebrae; also the 10th dorsal. In all diseases complicated by bronchopneumonia guard against exposure to cold and wet, until the predisposing disease is cured. In acute infectious diseases keep the mouth carefully cleansed. The temperature of the room should be kept the same at all times and about 68°. The diet should be liquid and consist principally of albumin water and milk broths. For high fever and cerebral symptoms adjust the atlas.

Lobar Pneumonia (Croupous Pneumonis; Lung Fever)

Etiology.—The primary and indirect cause is diminished resistance, due to faulty innervation. Predisposing causes are exposure to cold, trauma and a previous attack. The direct cause is the micrococcus lanceolatus, pneumococcus, or diplococcus pneumoniae.

Pathology.—One or more entire lobes of the lungs are first congested, the capillaries being greatly distended. Red hepatization in which the alveoli are filled with leucocytes, red blood cells and fibrin, and dead epithelial cells; the lung during this stage is of deep red color, very friable, and sinks in water. During the stage of gray hepatization, the exudate consists principally of leucocytes and is becoming necrotic, giving the lung a gray color.

Symptoms.—There usually are no premonitory symptoms, the onset being very sudden, with a chill. This is followed by a rapid rise in temperature to 104°-105°. Characteristic symptoms are sharp pains in the affected side, flushed cheek on the affected side, cough, which at first is dry, harsh and painful and later is accompanied by expectoration of a viscid rusty-colored sputum; marked dyspnea.

The characteristic physical signs of the first stage of pneumonia are the crepitant rales. The characteristic signs of the second and third stage are increased vocal fremitus,

dullness on percussion, bronchial breathing and bronchial voice.

Adjustment.—Adjust the 4th cervical and the 1st, 3rd and 10th dorsal vertebrae. The diet should be light and large amounts of water should be given the patient. The patient should remain in bed and plenty of fresh air provided. When the heart is weak, adjust the 7th cervical or 2nd dorsal.

Diseases of the Pleura

Pleurisy

Etiology.—Primary pleurisy is due to defective innervation of the pleurae, superinduced by exposure to cold and wet. Injuries of the chest walls may also cause it. Secondary pleurisy accompanies pneumonia, tuberculosis, pericarditis, measles, scarlet fever, smallpox, rheumatism and Bright's disease. Chronic pleurisy follows an acute attack, as a result of a low grade of resistance induced thereby in the pleura. It also may be the result of tuberculosis, alcoholism and cancer.

Pathology.—Pleurisy is divided into four stages. The first stage is called the dry stage; the pleural surfaces are dry and roughened instead of moist and smooth and glistening as they are in health. The second or plastic stage is characterized by an effusion of a small amount of viscid fluid, which covers the surfaces of the pleurae, and has a tendency to cause them to adhere to each other. The third stage, or stage of liquid effusion, is characterized by the presence of a greater or less amount of fluid in the pleural sac. The fourth stage, or stage of absorption, is that during which the fluid is becoming gradually absorbed. If the effusion is on the left side, the heart is pushed to the right, and if the effusion is on the right side, the heart is forced over to the left still further. The lungs are compressed, and displaced upward and against the spinal column. In chronic pleurisy the fluid which is present is pus, which is walled off by adhesions, which are thrown about the infected area.

Symptoms.—The acute variety begins suddenly with a chill, followed, by sharp pains in the affected side, which are increased by coughing and respiratory movements. Other symptoms are rapid, shallow respiration, a short, dry cough,

rise in temperature, and rapid pulse. As the liquid accumulates, the pain abates, while dyspnea increases, cough becomes aggravated, the heart action is impaired, and cyanosis develops. As the fluid becomes absorbed, the symptoms become less pronounced.

The subacute variety begins gradually after cold and exhaustion, in individuals in whom the resistance is low, as a result of faulty innervation. The patients usually complain of a sense of fatigue, dyspnea on exertion, evening rise in temperature, night sweats, and a short, hacking cough with little or no expectoration. The pulse is weak, thready and rapid. No pain is present.

The chronic variety runs a long course, and characteristic symptoms are irregular chills and fever, palpitation of the heart, dyspnea, night sweats, and more or less prostration.

The physical signs of the first stage are diminished movement of the affected side, and a corresponding increase on the healthy side. Palpation shows slight diminution of the vocal fremitus. Auscultation reveals a friction sound. During the second stage there is still more restricted movement on the affected side, vocal fremitus still more diminished, resonance on percussion is lessened, and crackling friction sounds are detected on auscultation. During the third stage inspection reveals absence of respiratory movements on the affected side, the intercostal spaces are widened and bulging; the vocal fremitus is absent; there is flatness on percussion, and the line of flatness varies with changes in the patient's position; auscultation reveals absence of all sounds on the affected side; mensuration shows the affected side of the chest to be one or two inches larger than the other side.

Adjustment.—Adjust the 4th cervical and 3rd dorsal vertebrae. The patient should be placed in bed at once. The diet should be confined to liquids or semi-solid substances. Strap the affected side with broad strips of adhesive plaster, to limit the movement and lessen the pain. The heart should receive careful consideration.

Pneumothorax

Etiology.—Perforating wounds of the chest wall; pointing of abscesses of the lungs or empyema through the chest wall; perforation of the lung by tubercular excavations, or

gangrene; perforation of the diaphragm in cancer of the esophagus, stomach, or intestine.

Pathology.—The lung is compressed against the spinal column and the pleural cavity is filled with gas.

Symptoms.—The presence of air in the pleural sac is a rare condition; the chief symptoms are its sudden onset with intense pain in the side, dyspnea, cyanosis and extreme prostration.

Physical Signs.—The affected side is enlarged and immobile; the vocal fremitus is diminished; tympanitic resonance on percussion. If fluid is also present, there will be flatness below its level, which changes with alterations in the patient's position. The respiratory sounds are weak or absent. Succussion, which is performed by grasping the patient by the shoulders, and vigorously shaking him, produces the splashing sound, when fluid and air are present in the pleural cavity.

Hydrothorax

Adjustment.—That of pleurisy with effusion.

Etiology.—An effusion of fluid into the pleural cavities is an accompaniment of dropsy in other parts of the body due to heart, liver, and kidney disease.

Symptoms.—The characteristic signs are cough, dyspnea, and cyanosis. No signs of inflammation are present, and the pulse and temperature are normal.

Adjustment.—Adjust the 4th cervical and 3rd dorsal vertebrae, and any other subluxations which may be found after a careful spinal analysis has been made. Diseases of the heart, liver or kidneys should be treated. The skin, bowels and kidneys should be kept active.

CHAPTER VII

Diseases of the Circulatory System

Acute Pericarditis

Etiology.—A primary inflammation of the pericardium rarely occurs, but the disease is usually due to other preexisting conditions, for example, gout, rheumatism, tonsillitis, scarlet fever, pneumonia, la grippe, infections, and tuberculosis. Subluxations producing impingement of the second and third pair of dorsal spinal nerves are very often found in this disease, and indicate that in part, at least, it is due to this cause. When the disease has existed for a short time reflex subluxations are produced, which prevent rapid recovery and cause the condition to become chronic.

Pathology.—During the first stage the surfaces of the pericardium are dry and roughened. In the second stage the surfaces are covered with a viscid material. The third stage is characterized by the formation of a greater or less amount of serous effusion. This effusion may become hemorrhagic or purulent.

Symptoms.—There may be no symptoms until effusion into the pericardium develops. There may be slight pain over the heart, and a moderate rise in temperature. In the first stage the heart action is irritable and forcible; there is no change in the area of cardiac dullness on percussion. The only characteristic sign of this stage is the pericardial friction sound, which is produced by the rubbing over each other of the roughened surfaces of the pericardium. After the inflammation has existed for a short time, effusion into the pericardial sac takes place. On inspection we note the pericardial area to be arched forward, and a diminution of the respiratory movements on the left side of the thorax. Palpation shows the apex impulse displaced upward and to the left; if, however, the amount of effusion is large, the apex beat will not be palpable. If the apex impulse is palpable when the patient is in the recumbent posture and absent when he is erect, it is almost certain that effusion into the

pericardial sac is present. On percussion the area of cardiac dullness is first increased upward, and later transversely. In this stage the pericardial friction sound becomes more and more indistinct, until finally it ceases to be heard. The normal heart sounds are very feeble, and the respiratory sounds are absent over the pericardial area. As recovery takes place there is a gradual return to normal of all the physical signs.

Adjustment.—Adjust the 4th and 7th cervical and the 1st, 2nd or 3rd dorsal vertebrae. The patient should be placed in bed, and absolute rest enforced to convert the column into a beam (spinal) and relieve the heart of unnecessary labor. The diet should be fluid; if, however, the amount of effusion is large, a dry diet is indicated. If the amount of effusion is so large as to cause dyspnea or other pressure symptoms, surgical measures are necessary.

Chronic Pericarditis

Etiology.—The chronic form usually follows acute pericarditis, and this is due to the reflex production of subluxations which produce impingement of the nerves which control the heart. Were these subluxations corrected as they developed in the acute form, it is unlikely that the chronic form would result.

Pathology.—The pericardium is thickened and covered with fibrin. Adhesions are present either between the two layers of the pericardium or between the pericardium and pleura. The heart is very often found dilated and hypertrophied.

Symptoms.—These are frequently not characteristic, but may be those of enlargement of the heart or failure of compensation. The apex beat is diffused, the area of cardiac dullness increased, and the heart action is irregular.

Adjustment.—Adjust the 4th cervical and the 2nd and 4th dorsal vertebrae.

Chronic Myocarditis

Etiology.—The primary and indirect cause of this disease is the progressive diminution of nerve force which accompanies old age, in which period of life the condition generally occurs. It also accompanies pericarditis and endo-

carditis and disease of the coronary arteries. Persons subject to arteriosclerosis as a result of deposition of lime salts in the arteries from faulty elimination also are subject to acute myocarditis.

Pathology.—There is no inflammation of the heart muscle but rather a replacement of the heart muscle with fibrous tissue. Hypertrophy of the heart may occur to compensate for the loss of muscle tissue, and this is later followed by aneurysm.

Symptoms.—There may be no definite symtoms. Those which may be present are dyspnea, rapid heart action, palpitation, angina pectoris, cardiac asthma, symptoms of collapse, and mental disturbances. In other cases the symptoms of broken compensation are present, and as a result of the hypertrophy the area of cardiac dullness is increased.

Adjustment.—Adjust the 4th cervical and the 2nd and 4th dorsal vertebrae. The Schott or Nauheim treatment which consists of graduated resisted exercise is a valuable adjunct in these cases. The patient should be moderate in all things.

Acute Myocarditis

Etiology.—When during the course of an acute infectious disease reflex subluxations affecting the nerves that control the heart are produced, acute myocarditis frequently develops. This is especially true in typhoid fever, scarlet fever, and diphtheria. It also accompanies acute pericarditis and endocarditis, in which the muscular coat of the heart becomes affected simply through extension of the inflammation to it.

Pathology.—There is granular degeneration of the muscle cells, and sometimes small abscesses of the heart wall develop.

Symptoms.—The characteristic symptoms of this disease are precordial pain, weak circulation, feeble heart action, and symptoms of collapse. The physical signs are those of sepsis and mild dilatation of the heart.

Adjustment.—Adjust the 3rd cervical and the 2nd and 4th dorsal vertebrae. Adjust for the accompanying disease.

Acute Endocarditis

Etiology.—There are two varieties of the disease: (1) The simple form; (2) The malignant form. The simple form of endocarditis usually follows rheumatic fever, typhoid fever, diphtheria, tonsillitis, chorea, and less frequently other infectious diseases. The malignant form sometimes follows any of the above diseases, in addition to which it often accompanies sepsis, tuberculosis, Bright's disease, erysipelas, and gonorrhea. In all cases reflex subluxations are produced in those spinal segments from which the heart receives its innervation; these tend to aggravate the condition, and, unless corrected cause it to be prolonged into the chronic form.

Pathology.—In plastic or simple exudative endocarditis there is a tendency to overgrowth of the valvular portions of the endocardium, as a result of the products of the inflammation, namely the fibrin, blood-platelets and leucocytes becoming organized. The aortic and mitral valves are most commonly affected. In malignant or ulcerative endocarditis portions of the valves are destroyed as a result of the ulceration.

Symptoms.—In the simple form there may be very few symptoms, among which may be mentioned dyspnea, disturbed cardiac action, nausea and vomiting, and a moderate rise in temperature. In the malignant form emboli are quite common and among the effects produced by them may be enumerated hematuria, spitting of blood, local gangrene, paralysis, and hemorrhage of the retina. The fever is high and may be accompanied by chills and sweats as in sepsis, or by prostration, delirium, and coma as in typhoid fever, or the disturbances may be chiefly cerebral. These varying symptoms all depend upon the comparative resistance of the respective parts of the body, those of low resistance as a result of deficient innervation being the ones which will be most readily affected.

Adjustment.—Adjust the 1st, 2nd or 4th dorsal vertebrae. Rest and avoidance of exposure during attacks of rheumatism, chorea, or diseases with which endocarditis is commonly associated. Absolute rest after the disease develops to convert the column into a beam and relieve the heart of work. For over-action of the heart, an ice pack

over the pericardium. Diet should be chiefly liquid, but not restricted. Stimulation as needed. Avoid early exertion after convalescence.

Chronic Endocarditis (Chronic Valvular Disease)

Etiology.—When in the course of an acute endocarditis the reflex subluxations which must occur as a result of the excessive flow to the segments which control the heart of afferent impulses are left uncorrected, the disease merges into the chronic form. This is due to the fact that the impingement of the nerves to the heart interferes with its innervation and permits of inflammatory changes which would otherwise not be possible. Most such cases may be traced to rheumatism, infectious diseases, and chorea from which the acute form resulted. An endocarditis which is chronic from the very onset may be caused by alcoholism, syphilis, gout, or excessive muscular exertion. In the aged atheromatous or fibroid changes in the lining of the heart may produce chronic endocarditis. Chronic Bright's disease may also cause it.

Pathology.—This is the same as that of the acute form after the process has become fully developed, namely after there has been either thickening of the valves or partial destruction of one or more of their segments.

Symptoms.—When the heart is compensating for the leakage, there may be no symptoms. When, however, compensation begins to fail, distress over the heart, irregular cardiac action, palpitation, dyspnea, vertigo, edema of the ankles, and other symptoms develop. When compensation is markedly impaired, the above symptoms are aggravated, in addition to which passive congestion in various parts and organs of the body develops, with its concomitant symptoms, as bronchitis, pulsating liver, scanty, albuminous urine, edema of the lungs, anasarca, and gastroenteritis. The heart action is irregular and the sounds are feeble. Anemia is present.

Varieties.—1. Aortic Regurgitation. 2. Aortic Stenosis. 3. Mitral Regurgitation. 4. Mitral Stenosis. 5. Pulmonary Regurgitation. 6. Pulmonary Stenosis. 7. Tricuspid Regurgitation. 8. Tricuspid Stenosis.

1. AORTIC REGURGITATION.—The apex beat is displaced downward and to the left. The area of heart dullness is increased. A murmur heard with and just after the second sound behind the sternum is heard.

2. AORTIC STENOSIS.—Slight increase of the heart dullness. A murmur is heard with the first sound of the heart, behind the sternum. Aortic murmurs are the only ones which are transmitted into the vessels of the neck.

3. MITRAL REGURGITATION.—The apex beat is displaced to the left and downward. The area of heart dullness is increased. A murmur is heard with the first sound of the heart with the greatest intensity at the apex, and is transmitted toward the left and around to the back on a line with the apex beat. The second pulmonic sound is accentuated.

4. MITRAL STENOSIS.—There is lateral increase in the heart dullness. The pulse is small. A murmur is heard during diastole, just preceding the first sound of the heart. The pulmonary second sound is accentuated.

5. PULMONARY REGURGITATION.—The murmur is heard best at the second intercostal space to the left of the sternum. It is heard with and following the second sound of the heart.

6. PULMONARY STENOSIS.—The murmur is heard best at the second intercostal space, to the left of the sternum, and occurs with the first sound of the heart.

7. TRICUSPID REGURGITATION.—Pulsating jugulars. Increase of heart dullness toward the right side. Venous engorgement is pronounced. A murmur is heard with the first sound of the heart, over the uncovered triangular space.

8. TRICUSPID STENOSIS.—The cardiac dullness is increased toward the right side. A murmur is heard just preceding the first sound of the heart, over the lower sternum, and is not transmitted.

Adjustment.—Adjust the 2nd, 4th and 7th cervical or the 9th to 12th dorsal vertebrae as indicated. When compensation is perfect, a regular, quiet mode of life should be followed, and all mental excitement, overwork, and worry be studiously avoided. Moderate exercise is very beneficial in these cases, but the patient should be warned of the dangers of excessive physical exertion, as running up stairs, exces-

sive work, etc. Exposure to damp and cold should be guarded against. High altitudes should be avoided, although the author has seen cases whose heart action was better in high altitudes than in low. The diet should be dry and moderate, and all stimulants should be eschewed. Tobacco and alcohol should never be used. When compensation is disturbed absolute rest in bed is indicated. Consultation in such cases is always advisable.

Hypertrophy of the Heart

Etiology.—Chronic diseases of the lung, for example, emphysema and fibroid phthisis; chronic pericarditis or endocarditis. Drugs, as tobacco and alcohol. Anything which causes increased resistance in the circulation, for example, arteriosclerosis, aneurysm, Bright's disease, or gout.

Pathology.—The heart is increased in size. The walls of that part of the heart which is involved are thicker than normal and the muscle is dark in color and very dense. Arteriosclerosis may follow on account of the increased strain put upon the vessels, and as a result of this apoplexy is apt to occur.

Symptoms.—The symptoms depend on the extent of the enlargement. If the heart is only enlarged sufficiently to compensate for valvular lesions, or other disturbances in the circulation as mentioned under the head of etiology, no symptoms will be present. But when the enlargement is greater than the requirements, it is shown by the following symptoms: The heart action is increased in frequency and very forcible; there are also headache, vertigo, dyspnea on exertion, redness of the face and eyes, nose-bleed, cough, tinnitus, distress in the precordial region, disturbed sleep, dreaming, and starting during sleep. The arteries are full, and the pulse is hard. The carotid arteries and others pulsate very forcibly.

Adjustment.—Adjust the 7th cervical and the 1st, 2nd, or 4th dorsal vertebrae. Avoid all excesses, as mental and physical over-exertion. Keep up the general nutrition. All stimulants such as alcohol, tea, coffee, and tobacco, should be interdicted.

Dilatation of the Heart

Etiology.—The common causes of dilatation of the heart are impairment of the nutrition of the heart muscles, hardening of the coronary arteries, and anemia. In addition to these causes, those operating to produce enlargement of the heart by thickening of its walls, namely, hypertrophy, also cause dilatation. Subluxations will be found as underlying causes in all cases.

Pathology.—Dilatation of the heart is usually associated with hypertrophy, and affects most often the right side of the heart. If the degree of dilatation is marked, the valves will be unable to close the orifices which they normally guard.

Symptoms.—The symptoms which are present in dilatation of the heart, are all due to weakening of the heart action, as a result of thinning of its walls, and are as follows: The pulse is feeble, symptoms of collapse are frequent, there is headache, cough, dyspepsia and constipation, dyspnea, scanty urine, dizziness, mental dullness, and finally edema of the ankles develops.

Adjustment.—Adjust the 7th cervical vertebra. The general nutrition should be improved in as far as possible, by a liberal diet. The amount of exercise taken should be moderate, and the skin, bowels, and kidneys should be kept active by appropriate adjustments.

Angina Pectoris

Etiology.—This disease is usually due to hardening of the coronary arteries. It is seen more in men than in women. It occurs most commonly during middle life. It is very often associated with aortic insufficiency, or when the pericardium is adherent. Persons whose arterial system is poorly constructed and who have reduced innervation to the heart are especially susceptible to this disorder.

Symptoms.—Following a day of excessive physical or mental exertion, the patient awakens during the middle of the night, suffering from an agonizing pain over the heart, accompanying which is a sense of impending dissolution. The pain usually radiates upward to the left shoulder, and down the left arm. The attack lasts from a few seconds to

possibly ten minutes. Following the attack, gas and acid eructation, profuse urination and exhaustion are present.

Adjustment.—Adjust the 7th cervical and the 1st, 2nd, or 4th dorsal vertebrae. In addition to these adjustments, give others for the relief of any possible causative factors. Careful dieting is indicated, to prevent the occurrence of flatulence and constipation. All mental strain and physical exertion should be avoided.

Fatty Heart

Etiology.—Fatty degeneration of the heart accompanies various conditions the chief of which are wasting diseases, anemia, alcoholism, arsenic or phosphorus poisoning, and diseases of the coronary arteries, pericarditis, or enlargement of the heart. It is seen most frequently in old age.

Pathology.—The cells of the muscle fibres are degenerated and broken down, while between the muscle fibres there are present numerous fat lobules.

Symptoms.—There are usually no symptoms until the heart becomes dilated, and the symptoms then are those of dilatation of the heart. Pulse is usually very slow, on account of the weakness of the heart muscle, which is largely replaced by fat. Dyspnea, collapse, pain over the precordial region are common symptoms.

Adjustment.—Adjust the 7th cervical and the 1st, 2nd or 4th dorsal vertebrae. Mental and physical exertion should be avoided. The diet should be generous, and consist of easily digested substances; meat, fat and starches should be especially forbidden. The patient should lie down for several hours each day.

Palpitation of the Heart (Irritable Heart)

Etiology.—This condition is due principally to interference with the conduction of those nerve impulses to the heart which regulate its action; as a result of this, the inhibitory influence of these nerves upon the action of the heart is withdrawn, and increased rapidity of the cardiac action results. Among the contributing causes may be enumerated anemia, mental worry, hysteria, over-exertion, menstrual disorders, dyspepsia, puberty, long continued use

of tobacco, alcohol, tea and coffee; it occurs most commonly in the female sex.

Symptoms.—There may be present and felt only a slight sensation of fluttering of the heart; on the other hand, there may be hot flushes, forcible pulsation of the arteries, the force of the apex beat may be increased, the pulse is rapid, difficult breathing, and nervousness. The attack of palpitation lasts from a few minutes to a number of hours, and usually follows mental or physical exertion.

Adjustment.—Adjust the 7th cervical and the 1st, 2nd or 4th dorsal vertebrae. The diet, sleep and exercise of the patient should be regulated.

Arrythmia

Etiology.—The primary cause of this disease is interference with the communicating nerves between the heart and its ganglia. Contributing causes are reflex, as from disease of the lungs, stomach, liver or kidneys; toxic, as the use of drugs, tea, coffee, alcohol; also organic diseases of the brain.

Symptoms.—The term arrythmia includes either irregularity in the action of the heart as to its rhythm, or a skipping of heart beats. In addition to the symptoms referable to the heart itself, there will be present also those of the underlying cause.

Adjustment.—The adjustment of this disease is the same as that for palpitation of the heart.

Bradycardia

Etiology.—The primary cause of this disease is an interference with the conduction of the nerve impulses which govern the heart's action. Secondary causes are other organic nervous diseases, in addition to which it also accompanies fibroid and fatty degeneration of the heart, and hardening of the coronary arteries. It is also seen very often during convalesence from such diseases as diphtheria, pneumonia, typhoid fever, rheumatism, and erysipelas.

Symptoms.—Bradycardia is considered to be present when the pulse beats have been diminished in number to 40 per minute. The slow heart action is the characteristic symptom, and the pulse is accordingly also correspondingly slow in addition to which it is thready. The first sound of

the heart is feeble, and indistinct, and the second sound is often not heard at all. Symptoms which are present as a result of a slow heart action, are attacks of fainting, dizziness, ringing in the ears, and sometimes even convulsions.

Adjustment.—Bradycardia being most usually simply a symptom of some other condition, the underlying cause should be determined, and proper measures instituted. As long as the slowness of the heart action does not interfere with the bodily requirements, no special measures are indicated; if, however, the opposite obtains, the patient should be put to bed and perfect quiet be maintained. Adjust the 3rd or 4th dorsal vertebra.

Tachycardia

Etiology.—The primary cause is failure of the inhibitory control of the heart, due to interference with the vagus nerve. Among secondary causes may be mentioned neurasthenia, chronic indigestion, continued high fever, excessive smoking, neuritis of the pneumogastric nerve, and the menopause.

Symptoms.—Preceding the attack there may be dizziness, ringing in the ears, and a foreboding. The attack itself comes on very suddenly, and the heart action is rapidly increased up to 200 beats a minute. The pulse is weak, thready, and irregular. The respiration is increased in frequency, there is difficult breathing. The skin is pale, but later becomes flushed. A smothering sensation is present, accompanied by a tight feeling about the heart. Such an attack lasts from a few minutes to a number of hours, or even days.

Adjustment.—Adjust the 7th cervical and the 1st, 2nd, or 4th dorsal vertebrae. Rest in bed is of great importance. In the intervals between attacks the habits should be regulated, and the patient should be forbidden to use any harmful substances such as tea, coffee, alcohol and tobacco.

Arteriosclerosis

Etiology.—The primary cause of this affection is defective metabolism, due to faulty innervation, as a result of which the deposition of lime salts in the walls of the arteries is permitted to take place; this converts the arteries from

soft tubes into very hard pipe-like structures. Secondary causes may be worry, physical or mental over-exertion, habitual over-eating, chronic poisoning, as by gout, syphilis, tobacco, alcohol. Chronic interstitial Bright's disease is also a very common cause of this condition.

Pathology.—The degenerative changes in the vessels may be confined to a certain part of the body, or be general. There is an overgrowth of the tissues of the middle and inner coats of the vessel walls. In advanced cases the arteries are very hard, thickened and tortuous.

Symptoms.—These are not always evident, and differ according to the arteries involved. When the sclerosis of the arteries is general, the vessels near the surface of the body have a hard, bony feel. The resistance to the circulation of the blood finally results in enlargement of the heart. Subjective symptoms present are dizziness, spells of unconsciousness, and apoplectiform seizures. When the vessels of the kidneys are hardened, Bright's disease develops. When the coronary arteries, or the aorta are hardened, angina pectoris and myocarditis develop.

Adjustment.—General adjustment, especially also adjustment of the atlas, 4th cervical, 5th and 10th dorsal, and 2nd lumbar vertebrae. The mode of life must be regulated. The bowels and kidneys must be kept active. Avoidance of alcohol, excesses of eating or drinking, exertion, excitement or worry. A dry diet consisting chiefly of vegetables, is to be preferred. A moderate amount of exercise is beneficial.

Aneurysm

Etiology.—The primary cause of aneurysm is defective metabolism, which is occasioned by an impaired action of the nerves, due to interference by subluxations of the vertebrae; as a result of the unbalanced metabolism, arteriosclerosis develops, and the vessel walls become weakened, permitting a portion of the wall to become pouched out. This occurs especially after hard work, or sudden exertion, which increases the blood pressure. Among the most common secondary causes may be mentioned alcoholism and syphilis.

Pathology.—The vessel walls are weakened and at the point of weakening, the vessel becomes dilated.

Symptoms.—There are two main varieties of aneurysm,

which are of importance, namely, aneurysm of the thoracic aorta, and of the abdominal aorta. The symptoms of an aneurysm of the thoracic aorta are a pulsation in the second and third intercostal space on the right side; prominence and enlargement of the cutaneous veins over the seat of the aneurysm; the apex beat is displaced; dullness on percussion; the pulse in the radial arteries, is unequal, or the pulse is delayed. As a result of the pressure of the aneurysm upon the trachea, dyspnea, pain, cough, hoarseness, aphonia, dysphagia may develop. The symptoms of abdominal aneurysm are epigastric pulsation, abdominal pain, vomiting, and unequal occurrence of the femoral pulses. This form of aneurysm may often be felt with the hand.

Adjustment.—Adjustment of the 2nd dorsal vertebra will diminish the pulsation of an aneurysm almost at once, and a course of adjustments have been claimed to have effected a cure. If constipation is present, adjust as indicated. If the case is seen early, absolute rest in bed should be enforced, and the ingestion of fluids limited to the smallest possible amount. In all cases of aneurysm excitement and worry should be avoided, and the use of stimulants and over-exertion be forbidden.

Varicose Veins

Etiology.—The cause of this condition is increased intravenous pressure or changes in the vein walls, both of which are primarily due to disturbed innervation, as a result of pressure upon the nerves which control the area involved.

Symptoms.—The symptoms usually complained of are a feeling of fatigue, and a sense of heaviness of the limb, after prolonged standing or walking. There are also present coldness of the feet, edema of the ankles, and a numbness of the legs; sometimes deep-seated pain is present. The characteristic sign of varicose veins is the twisted, enlarged and knotted veins which may be seen upon the leg.

Adjustment.—Adjustment in the lumbar region. Anything which obstructs the circulation must be removed, for example, tight garters. The bowels must be regulated, and prolonged standing and excessive walking should be avoided,

although a certain amount of exercise is very beneficial in these cases. If the condition has developed very suddenly, the limb must be rested for a considerable length of time, maintained in the horizontal position, and the vein protected from any strain for at least a month. The general health should be maintained by hygienic measures.

CHAPTER VIII

Diseases of the Digestive System

Diseases of the Mouth

Catarrhal Stomatitis

Etiology.—This is the commonest form of inflammation of the mouth and is usually due to various irritants, as tobacco, acids, hot drinks, etc. It is seen most commonly in young children, and is due in those cases to delayed dentition, and also infectious fevers.

Symptoms.—There are pain, redness, swelling of the mucous membrane of the mouth, bad breath, a slight rise in temperature, and retarded secretion.

Adjustment.—Adjust the 4th cervical and the 5th dorsal vertebrae. Remove the exciting cause. Regulate the diet.

Aphthous Stomatitis (Canker)

Etiology.—This form of inflammation of the mouth is seen most commonly in childhood, and is due to delayed dentition, eruptive fevers, indigestion and uncleanliness. These must be considered as the secondary causes of the disease, while the primary cause is an interference with the conduction of normal nerve impulses to the mucous membrane of the mouth. Soon after the disease has developed, reflex subluxations are produced, and as a result of the interference with the nerve supply, the condition becomes aggravated, and may develop into the ulcerative or gangrenous type in some cases.

Pathology.—The follicles and mucous membrane of the mouth and tongue are first inflamed; soon small reddish spots form, which later coalesce to form large, white patches, which later rupture and leave an ulcer, which is slow in healing.

Symptoms.—The chief symptoms of this disease are dysphagia, pain, slight rise in temperature, and a fetid breath.

Adjustment.—Adjust the 4th cervical and the 5th tho-

racic vertebrae. Remove the exciting cause if possible. The mouth should be cleansed after each feeding in the case of infants, and nursing bottles and nipples should be sterilized by boiling.

Ulcerative Stomatitis

Etiology.—This disease frequently follows the aphthous form, and is commonly due to poor hygienic surroundings, and an insufficient amount of proper food.

Pathology.—Small ulcers having a white or greyish base, are situated most commonly on the gums.

Symptoms.—The gums are swollen, bleed easily, and are very sensitive. There is enlargement of the submaxillary lymph glands. The flow of saliva is markedly increased, the breath is fetid, and there may be pronounced constitutional symptoms.

Adjustment.—Adjust the 4th cervical and the 5th dorsal vertebrae. In some cases the ulcers are very large and heal with difficulty. In such a case it is advisable to employ medicinal measures.

Gangrenous Stomatitis (Cancrum Oris, Noma, Water Cancer)

Etiology.—This disease attacks especially children of low vitality, brought about by faulty innervation. The direct cause may be a microorganism, but its character is not as yet understood. This disease is seen very often as a sequel to typhoid fever, pneumonia, scarlet fever and measles.

Symptoms.—The disease begins very suddenly. A necrotic spot is first seen on the inside of the cheek, which spreads and finally causes sloughing of a great portion of the tissue, the cheek even becoming perforated at times. The tissue about this gangrenous portion is hard and swollen. There are extreme constitutional symptoms.

Adjustment.—If the case is seen early, adjustment of the 4th cervical and the 5th dorsal vetebrae, together with hot compresses over the affected side of the face, may be effective. Usually, however, the condition has advanced so far that surgical measures are necessary.

Parasitic Stomatitis (Thrush)

Etiology.—The direct causes of this disease are parasites. The predisposing causes are improper food, uncleanliness , and a low grade of vital resistance.

Symptoms.—The mouth is the seat of small, whitish spots, which are usually confined to the tongue, but may, however, involve the entire mouth, and even extend to the larynx and esophagus.

Adjustment.—Adjust the 4th cervical and 5th dorsal vertebrae. Regulate the diet. Keep the mouth thoroughly cleansed.

Mercurial Stomatitis

Etiology.—The cause of this condition is an excessive amount of mercury in the system. Such a condition may be acquired either by the ingestion of an excessive amount of mercury for medicinal purposes, and in those whose occupations makes it necessary for them to work with mercury.

Symptoms.—There is salivation, sensitiveness of the gums, fetid breath, a metallic taste, and marked redness of the mucous membrane lining the oral cavity. If the case is extreme, the maxillary bones may become necrotic and the teeth fall out.

Adjustment.—Adjust the 4th cervical and 5th thoracic vertebrae. The use of mercury should be discontinued immediately, or the patient's occupation be changed, as the case may be. Thorough elimination through the skin, bowels and kidneys by appropriate adjustments should be instituted in order to rid the system of mercury as quickly as possible.

Diseases of the Stomach

Acute Gastritis

Etiology.—The primary and indirect cause of Acute Gastritis are those different impaired conditions of the system in general, in which, as a result of faulty innervation, due to subluxation of the vertebrae, the functional activity of the stomach is lessened or changed. Predisposing factors to acute gastritis are improper hygienic surroundings, malnutrition, anemia, and adynamic states. It is seen very frequently in tuberculosis, cancer and malaria; also in sclerosis of the liver and various cardiac and renal diseases. The direct and exciting causes are chiefly dietetic. These include eating too much food, food of an improper quality, which is poisonous, or too highly seasoned.

Pathology.—The lining membrance of the stomach is swollen, congested, and covered with a grayish, tenacious mucus. The most marked inflammation is at the pyloric end of the stomach. In cases due to poisoning, numerous eroded spots are seen upon the mucous membrane, and destructive changes may be present in the mucous and muscular coats.

Symptoms.—The symptoms vary in accordance with the degree of the inflammation. In severe cases there may be persistent vomiting of a greenish fluid, which consists of a watery substance mixed with bile. The tongue is heavily coated, the breath is fetid, there is intense thirst, a moderate degree of fever, pain and tenderness in the epigastric region. Headache and general prostration also accompany the condition.

Adjustment.—Entire abstinence from food for a period of from 24 to 48 hours. Even water should not be allowed, and to relieve the intense thirst which is present, the patient may be permitted to place in the mouth small lumps of ice. Rest in bed is also indicated to convert the columns into a beam. Adjust the 5th, 6th or 7th thoracic and 1st, 2nd or 3rd lumbar vertebrae.

Chronic Gastritis

Etiology.—This is usually due to faulty innervation of the stomach, whereby the functional activity of the stomach is markedly impaired, and permits the contributing factors to still further aggravate the condition. Among the contributing factors are especially improper, hasty, and irregular and excessive eating. In addition to those causes, chronic gastritis also accompanies other diseases of the stomach, as cancer, ulcer and dilatation, and is seen in diseases of the lungs, especially tuberculosis, in valvular disease of the heart, cirrhosis of the liver, Bright's disease, gout, and diabetes.

Pathology.—The stomach is usually enlarged, its walls are thickened, and there is an excessive secretion of mucus. The mucous membrane lining the stomach may be degenerated and erosions be present. The secretory glands of the stomach are dilated and atrophic.

Symptoms.—The most characteristic symptoms of this disease are morning nausea and vomiting of slimy mucus.

The appetite is impaired, the tongue is covered with a brownish coat, there is a bad taste in the mouth, and the breath is foul. There are pains and an oppressive feeling in the epigastrium, after meals, and vomiting frequently occurs immediately after the meal, or several hours thereafter. Headache, nausea, depression and melancholia are common symptoms. Constipation is common. The motor power, secretory and absorptive function of the stomach are markedly impaired.

Adjustment.—Adjust the 5th, 6th or 7th thoracic vertebrae. Adjustments should also be made in the upper cervical vertebrae, for their influence upon the vagus nerves. In all cases in which the catarrhal condition of the stomach is due to some other disease process, attention should be given to such causative factors. Correct the diet, and instruct the patient to drink a glass of hot water an hour before breakfast each morning. Regulate the bowels. Exercises, especially brisk walking in the morning are very useful in these cases.

Dilatation of the Stomach

Etiology.—The direct cause of dilatation of the stomach is interference with the conduction of those nerve impulses which are essential to its organic integrity. As a result of the withdrawal of these impulses, the muscles of the stomach become flabby and weak, and enlargement of the stomach follows. Contributing causes are habitual overeating, a narrowed condition of the pyloric orifice from tumors or following an ulcer, or thickening of a section of the wall at that point in chronic catarrh of the stomach. Weakness of the muscular wall of the stomach also occurs in wasting diseases, as tuberculosis, cancer and anemia.

Symptoms.—There is dull pain over the stomach. Loss of appetite. Loss of flesh and strength. The area of tympanic resonance on percussion over the stomach is greatly increased. Vomiting occurs several hours after meals, and the vomitus consists of a large amount of undigested food. The motor, secretory and absorptive powers of the stomach are all deficient.

Adjustment.—Adjust the 1st, or 2nd cervical, the 5th, 6th or 7th dorsal, and the 1st, 2nd or 3rd lumbar vertebrae.

The stomach should be thoroughly washed out each morning with a solution of bicarbonate of soda in warm water in severe and intractable cases. The diet should be concentrated and dry, liquids being reduced to a minimum, because the excessive weight of a heavy meal aggravates the dilatation. Fats and starches should be eliminated. Daily exercise in the open air, by building up the skeletal muscles also strengthens the muscular wall of the stomach.

Gastric Ulcer

Etiology.—Ulcers of the stomach are due to a disturbance of the nutrition of a limited section of the mucous lining of the stomach, as a result of faulty innervation of the organ. This section of the stomach is then subject to digestion by the gastric juice, which, in these cases, always contains an excessive amount of acid. Gastric ulcer is seen more commonly in women than in men, and between the ages of 20 and 30. It is common in those whose occupation requires continuous bending forward, such as tailors and shoemakers; in these people the intervertebral foramina of the mid-dorsal region are consequently diminished in size, on account of the compression of the intervertebral discs, and as a result of the consequent impingement of the nerves to the stomach, which are derived from this region, the nutrition of the lining of the stomach suffers.

Pathology.—A typical gastric ulcer is usually single, and occurs most often at the pyloric end of the stomach. Such an ulcer is usually about one-fourth of an inch in diameter, its edges are clean cut, and its floor is smooth. Such an ulcer may erode into a blood vessel and produce hemorrhage. Sometimes the ulcer penetrates the entire thickness of the stomach wall, and perforation of the stomach, followed by peritonitis, results. Stenosis of the pyloric orifice frequently follows healing of the ulcer, and dilatation of the stomach then is very apt to occur.

Symptoms.—The most characteristic symptoms of gastric ulcer are circumscribed pain and tenderness, which the patient indicates by pointing with the finger to the spot affected. Vomiting is common, and the vomitus may contain blood, although it is more common to find blood in the stools. There is distress and a heavy feeling in the stomach,

soon after eating, and vomiting very frequently occurs. The pain may occur again several hours after eating, and is then produced by the passage of food into the intestines over the eroded lining of the stomach at the pyloric orifice. When vomiting of blood occurs, the blood is usually bright red, unless it has remained in the stomach for some time, or become partially digested, in which case it will be dark brown. Loss of flesh and strength, and progressive anemia. are common. An excessive amount of acid in the gastric juice is characteristic.

Adjustment.—Adjust the 5th, 6th or 7th dorsal and the 1st, 2nd or 3rd lumbar vertebrae. In cases of hemorrhage an ice bag should be placed over the stomach and the patient remain in bed for three or four weeks; during this time the diet should be liquid, and if even this is not tolerated by the patient, rectal feeding must be instituted.

Cancer of the Stomach

Etiology.—Cancer usually occurs in parts which have been subjected to long continued irritation, and consequently in the stomach it occurs very commonly in those who have suffered for years from chronic catarrh of the stomach, also following gastric ulcer, or trauma. Family predisposition seems to have some influence. It occurs most usually in persons over 40 years of age. No specific cause of cancer of the stomach is known, but many theories have been advanced, and it is possible that defective innervation of the stomach may produce it by permitting the overgrowth of a new form of cells to occur, which later constitute what is known as a cancer.

Pathology.—Several varieties of cancer occur in the stomach, namely, scirrhous, colloid, medullary and cylindrical cells. The cylindrical cells and scirrhous forms usually are situated near the pylorus, while the other forms are scattered throughout the stomach. When the growth is located at the pyloric end of the stomach, obstruction occurs and the stomach becomes dilated; if, however, the growth is situated at the cardiac end of the stomach, that orifice is constricted, and dilatation of the esophagus takes place.

Symptoms.—The first symptoms of cancer of the stomach are usually indigestion for a short time, together with

progressive anemia, and a gradual loss of weight. These symptoms are followed by loss of appetite, nausea and vomiting, an hour or two after eating, and containing blood which is partially digested and black, and has the appearance of coffee grounds. There is a gnawing, burning pain in the epigastric region, back, and between the shoulders, which is usually increased by taking food. Loss of flesh and strength is progressive, secondary anemia develops, and finally the patient becomes cachectic. The skin is pale, yellowish and dry. The tumor can often be felt, and is nodular and freely movable. Analysis of the stomach contents shows absence of hydrochloric acid, and the presence of lactic acid.

Adjustment.—The prognosis in cancer of the stomach is generally considered to be decidedly unfavorable. Some chiropractors claim to be able to cure cancer by means of spinal adjustment, if the case is seen early, but admit its hopelessness if the case is at all advanced. In the author's opinion, the only respite for cancer of the stomach is early excision, before metastases have occurred. The management is otherwise palliative; the patient should eat easily digested food; the stomach should be washed out every second day and supportive measures should be employed. Adjust the 5th, 6th or 7th dorsal vertebra.

Neuroses of the Stomach (Nervous Dyspepsia)

Etiology.—The cause of the various forms of gastric neuroses is an interference with the conduction of those nerve impulses which are essential to its secretory and motor activity. The stomach requires for its functional activity and organic integrity a continuous and uninterrupted nerve-supply and when this is withdrawn the secretion of the gastric juices becomes deficient, motility is diminished, and various disorders supervene.

Symptoms.—Nervous dyspepsia manifests itself in many different ways, chief among which are the following: 1. The Secretory Neuroses are hyper-acidity, namely, an excessive amount of secretion of hydrochloric acid; subacidity, which is a deficient amount of hydrochloric acid in the gastric juice. 2. The Motor Neuroses, which are increased motility; nervous eructations, which are very noisy,

and the gas which is expelled is chiefly air which has been previously swallowed; nervous vomiting, in which there is no nausea or retching; peristaltic unrest, in which the patient is conscious of the movements of the stomach; rumination, which is the regurgitation and chewing of food; insufficiency of the cardiac or pyloric orifices; spasms of the cardiac or pyloric orifices. 3. The Sensory Neuroses, hyperesthesia, in which various sensations are experienced about the stomach, during digestion; gastralgia, which is characterized by paroxysmal pains about the stomach and radiating to the back, and which is relieved by taking food; anorexia nervosa, which is extreme dislike for food; akoria, which is the absence of sense of satisfaction following eating; bulimia, which is the term applied to frequent attacks of excessive hunger.

Adjustment.—In addition to the general nervous basis, namely hysterical or neurasthenic, which so often underlies the gastric neuroses, and which require general adjustment, the adjustment of the specific subluxation which interferes with the innervation of the stomach should be attended to; these are the upper four cervical, the 7th cervical, and 5th. 6th or 7th thoracic vertebrae. Coccygeal adjustment is often indicated.

Diseases of the Intestines

Acute Enteritis (Inflammation of the Bowels, Acute Diarrhea, Intestinal Catarrh)

Etiology.—The most common causes of this condition are excessive eating and drinking, especially of improper food, or food which is indigestible or decomposed; it is seen especially during the summer season, and follows exposure to cold and wet while perspiring. The disease is seen very frequently in children whose vital resistance is reduced and whose intestinal tract is not receiving its full quota of innervation, and follows imperfect hygiene and the presence of foreign bodies in the intestines.

Pathology.—The mucous membrane lining the intestinal canal is congested, red, swollen and edematous; later there is a peeling off of the epithelium, and an excessive secretion; as a result of the extreme congestion, numerous capillaries in the walls of the intestines rupture, and hemor-

rhages ensue. The glands in the stomach are also swollen and congested, and have a tendency to ulcerate. Such a process may involve only sections of the intestinal tract, or the entire tract.

Symptoms.—The onset is sudden, with extreme diarrhea, stools being watery and colic being present. There is an excessive amount of gas in the intestines, extreme thirst, and symptoms of collapse may supervene.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. The patient should be confined to bed, in so far as possible, and hot compresses be applied over the abdomen to give immediate relief until results are obtained by adjustments. The diet should be liquid, although withdrawal of all foods is preferable. A high rectal enema should be given to cleanse the bowels. Supportive measures should be employed.

Chronic Enteritis

Etiology.—This disease may follow the acute form, in which case the underlying cause is a subluxated vertebra. It is commonly seen in chronic diseases such as Bright's disease, tuberculosis, malaria, and in tubercular or cancerous ulcers of the bowels. It often results from the chronic congestion which is present in obstruction of the portal circulation as seen in atrophic cirrhosis or cancer of the liver.

Pathology.—The mucous membrane of the intestine is covered with stringy mucus, and shows hemorrhages and erosions. The sub-mucous and muscular coats of the intestines are thickened, the glands in the mucous lining are atrophied, or the muscular layer may be also atrophied, in which case the intestinal wall as a whole will be very much thinned.

Symptoms.—These may develop gradually, or may follow at once the acute form of Enteritis. The chief symptom is diarrhea, with or without colic, alternating with constipation. When the large bowel is chiefly affected, the stools are thin and watery and contain a large amount of mucous. When the process involves chiefly the small intestines, portions of undigested foods and a certain amount of mucous are present in the stools. The abdomen is distended

with gas. There is gradual loss of weight and strength, and anemia may develop.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra and the coccyx. Hygienic measures, fresh air, warm clothing. The diet should consist principally of milk for several weeks, and the return to the natural diet should be very gradual.

Intestinal Indigestion

Etiology.—This disease is a functional derangement, due to subluxations in the lower dorsal and upper lumbar region, which, by producing impingement upon the nerves governing the functional activity of the intestinal tract, result in a diminution of the various intestinal secretions and deficient peristalsis of the bowels. As a result of the deficiency in the digestive juices in the intestines, and also deficient motility of the bowels, foods are left undigested, and fermentation and decomposition result. Other direct causes may be family predisposition, improper diet, or improper methods of eating, excessive use of alcohol and tobacco, mental or physical over-exertion, and diseases of the stomach, liver, kidneys, and pancreas. These different conditions may all directly operate in the production of intestinal indigestion, when the primary causative factor, disturbed innervation, is present.

Symptoms.—This disease may be either acute or chronic. The acute variety is usually the result of the presence of some form of irritation in the small intestines, the characteristic symptoms of which are a slight rise in temperature, anorexia, headache, diarrhea, coated tongue, and tympanites. In more severe attacks, inflammation may also exist, which, by extending into the bile ducts, causes obstruction to the outflow of bile into the intestines, and jaundice, clay-colored stools, and highly-colored urine are the characteristic symptoms of such a condition. Diarrhea is a common symptom, the stools being at first normal, and later becoming thin and watery, and containing large quantities of mucous.

The symptoms of the chronic form are pain several hours after eating, tenderness of the abdomen, tympanites, and constipation. As the disease progresses, anemia, loss

of flesh and strength, and functional disorders of the liver, together with nervousness, develop. All the symptoms of malassimilation later develop.

Adjustment.—Adjust the 11th vertebra. In the chronic form coccygeal adjustment is very valuable. The diet should consist of substances which are bland and non-irritating, and easily digested, and fats and starches should be especially avoided. A fast of three days is indicated. The patient should take a moderate amount of exercise in the open air every day, although not to the point of producing physical exhaustion. When the disease is due to some other affection, adjustment should be directed toward the relief of the latter.

Constipation (Costiveness)

Etiology.—The primary cause of this disease is a subluxation of the lower dorsal or upper lumbar vertebrae which produce impingement of the nerves which govern the intestines. The impingement of the afferent nerves prevents the conduction of those impulses from the bowel, which excite the defecation centers to action. The impingement of the efferent nerves interferes with the conduction of those motor impulses which produce the movement of the intestines. Many cases of constipation are due simply to the first mentioned cause, namely impingement upon the afferent nerves, in which case the impulse to defecation is not perceived by the patient. When in addition to this the efferent nerves are also impinged, the motor impulses which excite the bowels to action, never reach the walls of the intestines. When the primary cause of constipation is present, the contributing factors, the product of the disease, aggravate the condition, which would be impossible, were the innervation of the bowels perfect. The secondary causes of constipation are a sedentary occupation, individual peculiarity, improper diet, and drugs. The disease also accompanies many other conditions.

Symptoms.—No special symptoms may be present, although any of the following signs of constipation may be met with: Headache, which is made worse by moving the head, intercurrent attacks of diarrhea, indigestion, dizziness, skin eruptions, and malaise.

Adjustment.—Adjust the 11th dorsal vertebra in spastic constipation, and the 1st or 2nd lumbar vertebra in atonic constipation. The next important measure is to regulate the habits of the patient; many persons from motives of pride, or inability to move the bowels at a certain time, so derange this function that constipation results; a regular time should therefore be had for attending to this function. Next in importance comes regulation of the diet, which in these cases should be meat-free, and consist of substances which are not concentrated.

Diarrhea

Etiology.—The cause of this condition is principally disturbed innervation to the intestines producing organic and functional derangements therein. Contributing causes are indigestion, improper food, and intestinal inflammation. Diarrhea also follows sudden changes in temperature, mental shocks, infectious fevers, and occurs in wasting diseases, such as tuberculosis, cancer and diabetes.

Symptoms.—Diarrhea may be present in two forms, first, the acute, and second, the chronic. The acute form of diarrhea may be of several varieties. For instance, (a) the bilious form which is caused by excessive bile in the bowels, and the symptoms of which are colic, burning of the anus, the stools being yellow or greenish. (b) The feculent form, which is the result of errors in diet, intestinal parasites, and indigestion, and the symptoms of which are colic after meals, nausea, a desire for stool, and gas. Stools are very offensive, and are fluid. (c) The lienteric form, in which the food passes through entirely undigested. In addition to the stools containing this undigested food, they also contain mucus and bile. The chronic form is also classified according to the nature of the stools. There are thus mucous stools, watery and serous stools, lienteric stools, black stools, red stools, bloody stools and green stools.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. If necessary, also adjust the 5th dorsal vertebra for its influence upon the stomach and the 10th dorsal vertebra when the kidneys are inactive. In acute cases of diarrhea all food should be withdrawn for a few days; in the chronic variety the diet should be made up of substances which

are easily digestible. In the acute form, rest in bed is indicated.

Cholera Morbus

Etiology.—This disease is seen most commonly during the summer and autumn months, and is brought about by sudden atmospheric changes, and the presence of irritants in the intestinal tract, caused by the eating of unripe fruits, vegetables, or the presence of decomposed foods. The condition is predisposed to by deficient innervation of the gastro intestinal system.

Symptoms.—The disease commences suddenly, with a chill, nausea and vomiting, and diarrhea, with intense intestinal colic. The vomitus first consists of the ordinary stomach contents, and later is made up of bile, and finally water. The stools at first consist of normal feces, later becoming green, and finally white, resembling rice-water. Great prostration is present. There is intense thirst. Rapid loss of strength and flesh supervene.

Adjustment.—Adjust the 5th, 6th or 7th and the 11th dorsal vertebrae. Hot compresses over the abdomen are gratifying to the patient. To relieve the extreme thirst, let the patient dissolve small pieces of ice in the mouth, but he should not be permitted to swallow the water.

Intestinal Obstruction

Etiology.—Intussusception or telescoping of the bowels; volvulus or twisting of the bowels; cancer of the wall of the intestines; stricture of the intestines; foreign bodies in the intestines; adhesions; tumors of neighboring organs pressing upon the intestines; strangulated hernia.

Symptoms.—The characteristic symptom of this condition is complete constipation although there may be passage of a slight amount of mucus and blood. Vomiting is an early symptom, the vomitus first consisting of stomach contents, then of partially digested food, and finally becoming fecal. There is great prostration. Severe pain is present in the abdomen, and after peritonitis has developed, as it usually does, marked tenderness is present. When the obstruction is in the small intestines, the umbilical region is distended; when the obstruction is in the large intestines, the iliac re-

gions are distended. When the obstruction is due to impaction of feces in the rectum, or to new growths in this location, palpation will reveal the condition.

Adjustment.—Adjust the 11th thoracic vertebra to relieve the condition if it is due to spasmodic contraction of the bowels, for the reason that this produces relaxation of the muscular coat of the bowel. Should these measures be unproductive of results, surgical interference becomes necessary.

Enteroptosis (Falling of the Viscera)

Etiology.—Downward displacement of the stomach and intestines, together with the liver, spleen and kidneys; it is seen most commonly in women who are of a highly nervous temperament. It often accompanies wasting diseases, in which there is a great loss of flesh. It is also due to weakness of the support of these organs, and weakness of the abdominal walls. The failure of the support of the organs to hold them in their proper position is due to the interference with the conduction of those constant impulses which maintain the muscles in a state of slight, permanent contraction. When subluxations occur in certain sections of the spine, and interfere with the conduction of these necessary nerve impulses, relaxation of the ligaments and other supports of the internal organs occurs, and falling of the viscera ensues.

Symptoms.—No special symptoms may be present, although patients frequently complain of headache, indigestion, dragging pain in the back, and a constant tired feeling, all of which are dependent upon the nervous basis underlying the condition. The displaced organs can readily be palpated. Constipation is also a common symptom. The abdomen is distended.

Adjustment.—After a careful examination of the abdominal viscera has determined the organs which are affected, and a spinal analysis has shown the location of the subluxation responsible for the condition, the proper adjustment should be made, and in many cases this restoration of the nerve impulses to the affected parts will greatly assist in the production of a cure. When the enteroptosis is due to a previous wasting disease, a diet designed for fattening the

patient should be prescribed. In neurasthenic individuals, hygienic and other measures should be employed. Use a firm abdominal binder in those in whom it is deemed advisable.

Intestinal Colic (Enteralgia)

Etiology.—This condition is more in the nature of a symptom than a specific disease, and is seen in persons of a neurotic temperament, being also predisposed to by general debility, mental overwork or worry, and chronic gastro-intestinal diseases. The direct causes are exposure to cold and damp, and the presence of some irritation in the bowels. It is also a frequent accompaniment of cerebrospinal diseases, locomotor ataxia and hysteria.

Symptoms.—The most characteristic symptom is spasmodic pain referred to the umbilical region, and migrating from one section of the abdomen to another; this pain may be either sharp or dull, and is relieved by pressure. There is cold perspiration, the face is pale, and there are symptoms of prostration. The passage of gas or feces usually terminates the condition.

Adjustment.—Adjust the 11th thoracic vertebra. For the relief of the colic, the application of hot compresses over the abdomen is very useful. In all cases the contributing cause of the intestinal colic should be corrected.

Mucous Colitis

Etiology.—This disease is seen most commonly in women who are of a neurotic or hysterical type. Causes which may operate in producing an attack are dyspepsia, indigestion of improper foods, and various emotions.

Symptoms.—This condition is chronic. There are periodical attacks, abdominal pain and tenderness, and the passage from the bowel of mucous casts. A great variety of nervous symptoms exist. Constipation is a prominent symptom.

Treatment.—Adjust the 1st, 2nd or 3rd lumbar vetebra. Attend to the general health of the patient.

Appendicitis

Etiology.—The primary cause of appendicitis is an interference with the conduction of nerve impulses to the appen-

dix. The low grade of resistance which then obtains in the appendix permits of the inflammation which is produced by the various contributing causes, chief among which are the fact that the appendix is not drained very readily, and consequently extension to it of an inflammation of the bowels readily closes its lumen, and any substances which may be imprisoned within the appendix, together with bacteria which are constantly present in the bowels, excite an inflammatory process therein. It is seen most commonly in young adult males. It may also follow typhoid fever, influenza and tuberculosis, or it may be a result of twisting of the appendix itself.

Pathology.—In simple cases there is merely a catarrhal inflammation of the appendix. This may go no further and recovery ensue. In some cases, however, there appears to be a marked tendency towards ulceration, especially when the innervation of the appendix is practically nil. In still other cases the appendix rapidly becomes gangrenous and perforation follows.

Symptoms.—The onset is usually very sudden, and generally occurs after eating a full meal. The first symptoms are nausea and vomiting; this is followed by a rapid rise in temperature, and severe pain, which is at first diffused over the entire abdomen, but later becomes localized to McBurney's point. Rigidity of the muscles in the right iliac region is present, and there is tenderness on light pressure over the appendix.

Adjustment.—In all cases of appendicitis it will be found that the 2nd lumbar vertebra is subluxated, and adjustment should be made at this point. In many cases this will alone be sufficient to limit the disease. Additional measures which are advisable to use, are withdrawal of all food, and rest in bed to convert the column into a beam. In those cases in which the disease is due to a twisting of the appendix or to the presence within it of a foreign substance, adjustment of the 11th dorsal vertebra by relaxing the musculature of the bowel, sometimes proves to be of great assistance in such instances.

If these measures fail to give relief, and it is evident that suppuration has taken place, surgical measures will have to be adopted.

Diseases of the Liver, Gall Bladder and Bile Passages

Congestion of the Liver (Torpid Liver, Biliousness)

Etiology.—Congestion of the liver occurs in two forms: First, the passive form which is due to diseases of the heart and lungs; second, the active form, which is due to chronic constipation, excesses in eating and drinking, especially of highly seasoned foods and alcoholic beverages. If, in the presence of these contributing causes the innervation of the liver is impaired, congestion will be certain to take place.

Pathology.—The liver is uniformly enlarged; its surface is smooth, and the free border is harder than normal, but smooth.

Symptoms.—There are pain and uncomfortable feeling in the region of the liver, gastro-intestinal disturbances, and sometimes jaundice. Occasionally there is vomiting of blood, and dropsy. There may be a slight bulging of the hypochondriac region, and pulsation of the liver may be seen. On percussion it is found that the area of liver dullness is increased.

Adjustment.—Adjust the 4th dorsal and 1st, 2nd or 3rd lumbar vertebrae. The diet should be corrected and a fast of a day or two at the onset of the disorder is followed by good results.

Fatty Liver

Etiology.—The primary cause of this disease is faulty innervation, which causes a disturbance in the balanced metabolism, and thus permits of the accumulation of fats in the liver. Contributing causes are general obesity, and an adynamic state due to tuberculosis, cancer, or other wasting diseases; lastly, severe anemia, prolonged use of alcohol, and phosphorus poisoning, all of which produce imperfect oxidation of the blood.

Pathology.—The liver is uniformly enlarged, and the enlargement often extends as far as the umbilicus. The surface of the liver is smooth, its edge is smooth and rounded and soft.

Symptoms.—Symptoms are usually absent. There may, however, be tenderness and pain in the hepatic region from the dragging weight of the enlarged organ, jaundice is rare, and dropsy never occurs in this condition.

Adjustment.—This should be directed first of all to the general obesity which is usually present, by adjustment of 6th and 10th dorsal vertebra. In addition to these adjustments, the segments controlling the liver, namely, the 4th and 8th dorsals, should also be made. Likewise adjust the 11th dorsal vertebra for its effect of dilatation of the liver. The diet should contain a minimum amount of fats and carbohydrates. The contributing causes should be corrected.

Waxy Liver (Amyloid Liver)

Etiology.—Waxy degeneration of the liver is seen most commonly in diseases attended by chronic suppuration, especially of the bones. It is also seen in connection with similar degeneration in the spleen and kidneys. It occurs also in connection with some infectious diseases, and in wasting diseases, in cancer, tuberculosis and syphilis. The reason that the liver becomes involved in the above mentioned conditions, is due to the fact that reflex subluxations are produced in segments of the spine which control several organs. These subluxations, by interfering with the conduction of the normal amount of nerve impulses to the liver, render it more susceptible to involvement by the same process which is affecting such other organs.

Pathology.—The liver is uniformly enlarged, its border is smooth and firmer than normal. The enlargement is extreme, and jaundice and dropsy appear late in the course of the disease.

Symptoms.—The enlargement of the liver is the only characteristic sign. On percussion the area of liver dullness is shown to be markedly increased. There is no pain. The enlargement of the spleen and kidneys, in connection with the enlargement of the liver, is diagnostic. Gastro-intestinal disturbances and loss of flesh and strength later occur.

Adjustment.—Adjust the 4th, 8th and 11th dorsal vertebra. If necessary, the area in which a suppurative process is existing, should receive surgical attention. The underlying cause should be corrected in as far as possible.

Cysts of the Liver

Etiology.—The cause of a cystic condition of the liver has been mentioned under the head of diseases due to animal

parasites, being caused by intestinal parasites, the tenia echinococcus, contracted most commonly from the dog. It is rare in this country, but is quite common in localities where conditions make necessary constant use of dogs by man. The eggs are ingested by man, and on being digested in the stomach and intestines, the liberated embryos find their way into the portal circulation, and thus reach the liver. They become lodged there and form the cysts.

Pathology.—The wall of the cysts consists of two layers, the inner layer being the one from which daughter cysts are formed. The irritation which is occasioned by the presence of these cysts, causes a capsule of connective tissue to be formed about them. Within the capsule is present a clear fluid. The parasite later dies, but the cyst grows slowly, and may later be dried up, or calcified, or changed into an abscess.

Symptoms.—The liver is enlarged in certain sections, and if the cyst is located on the under surface of the liver, it may be palpated as a round, fluctuating mass. If it is situated on the upper surface of the liver, it points into the pleural sac, and may in such cases resemble pleurisy with effusion. To differentiate these two conditions it must be remembered that the line of flatness in pleurisy with effusion is perfectly horizontal, while in cysts of the liver the upper line of flatness is curved. Jaundice sometimes occurs; dyspnea by pressure on the lungs is sometimes present, as well as fever and pain.

Adjustment.—Adjust the 4th and 8th dorsal and 1st, 2nd or 3rd lumbar vertebra. In some cases surgical measures are necessary.

Abscess of the Liver

Etiology.—The primary cause of abscesses of the liver is faulty innervation of that organ, with a consequent diminution in its vital resistance. In the presence of such a condition, the contributing causes, namely, trauma, dysentery, typhoid fever, pelvic abscesses, and intestinal ulcers, in which the affected medium reaches the liver, via the portal circulation, produce abscesses in the liver. Abscesses of the liver in such cases are always multiple. Single abscess of

the liver usually occurs in tropical countries, following dysentery, and the colon bacillus is the exciting cause.

Pathology.—The liver is irregularly enlarged, and if the abscesses are near the surface they may be palpated as round, fluctuating masses.

Symptoms.—The characteristic sign of abscess of the liver is the enlargement of that organ. Tenderness is always present, and a dragging pain which is referred to the right shoulder is complained of. Jaundice usually occurs. Slight fever may be present, or it may be more of the septic type, namely, alternating with chills.

Adjustment.—Adjustment of the 4th and 8th thoracic and the 1st, 2nd or 3rd lumbar vertebrae early in the condition may have a favorable influence upon it. Close and constant observation of the patient is necessary at all times, as surgical interference may become necessary.

Cancer of the Liver

Etiology.—This disease occurs most commonly in men at the age of 40 to 60 years; heredity seems to have some influence; there are various kinds of irritation, including trauma, which may also be considered as etiological factors. It is rarely primary. Usually it is secondary to cancer in other organs or parts of the body, especially the intestines, stomach, pancreas, or gall bladder.

Pathology.—The liver is greatly increased in size, in fact, cancer of the liver causes greater enlargement in size than any other condition. The edge of the liver is nodular, and the nodules are harder than the surrounding liver substance, and are also very tender. The surface of the liver is also nodular. Jaundice is present, and later in the course of the disease, ascites develops.

Symptoms.—Various gastro-intestinal symptoms precede the actual development of carcinoma of the liver. Later on, however, pain and distress in the abdomen, together with a feeling of weight, are noticed by the patient. Jaundice and dropsy next occur, and the symptoms of cachexia develop. There is no fever unless there are complications toward the end of the disease. Palpation elicits tenderness, and the percussion note of dullness is increased.

Adjustment.—Make adjustments of the 4th and 8th dorsal vertebrae. Otherwise the care is symptomatic.

Acute Yellow Atrophy

Etiology.—This disease occurs most commonly in young women between the ages of 20 and 30, during pregnancy. The real cause is uncertain, but it seems to be some form of poison circulating in the blood.

Pathology.—The liver is greatly decreased in size, and its capsule is wrinkled. The liver cells are degenerated. The spleen is often enlarged, and there is degeneration of the muscles, heart and kidneys.

Symptoms.—During the first two weeks of the disease there are no symptoms except jaundice. Dangerous symptoms then rapidly develop, among which may be enumerated, headache, delirium and excessive vomiting. Hemorrhages into the mucous membranes occur. The patient soon passes into collapse and the typhoid state. Stools become clay-colored, or contain blood. There is usually no fever, except occasionally just before death.

Adjustment.—Adjust the 4th and 8th dorsal vertebrae. Otherwise the case is symptomatic.

Jaundice (Acute Catarrh of the Bile Ducts)

Etiology.—Among the most common causes of jaundice may be mentioned an extension of a catarrhal inflammation from the stomach or duodenum, gall-stones, rapid congestion of the liver, emotions, and infectious fevers.

Pathology.—There is inflammation of the duodenum, and the mucous lining of the bile passages; as a result of this condition the mucous lining of the gall ducts becomes thickened, and closure of the bile passages takes place, thus obstructing the outward flow of bile into the intestines. The bile which is thus retained in the bile passages in the liver is absorbed by the blood, and tingeing of the skin follows.

Symptoms.—The characteristic symptom is a yellowish discoloration of the skin and mucous membranes.

Other symptoms are clay-colored stools and constipation, pruritis, hemophilia, gastro-intestinal disturbances, debility, insomnia, and mental dullness.

Adjustment.—Adjust the 4th and 8th dorsal vertebrae.

A change of climate and correction of the mode of life are always desirable. The bowels should be kept open.

Gall Stones (Cholelithiasis)

Etiology.—The primary cause of this disease is an interference with the conduction of those nerve-impulses to the liver which govern its secretory activity, and consequently the character of the bile. It is from these changed secretions of the liver that the calculi are partly or entirely derived. In some cases bacteria, especially the typhoid bacilli, form the nucleus about which the bile salts deposit to form a stone; at other times hardened mucous is the nucleus of the stone. The disease is commonly seen in women around the age of 40 years, and is predisposed to by obesity, sedentary habits, tight lacing, previous typhoid fever, and excessive eating and drinking.

Symptoms.—In most cases of gall stones no symptoms are present. It is only when the stone becomes lodged in one of the ducts that symptoms develop. If the stone is situated in the common duct, or the hepatic duct, jaundice is present, owing to the obstruction to the outflow of bile. In addition to jaundice, when the stone is lodged in the common duct, the bladder is also distended, and is readily palpable beneath the free border of the ribs, at about the apex of the 9th rib. Upon the obstruction of a duct by a gall stone, hepatic colic develops, and is recognized by the agonizing pain which is experienced in the right side of the abdomen, and which is referred to the right shoulder. Fever may be present, and persistent vomiting and symptoms of collapse may supervene. Such an attack may last from a few minutes to several days.

Adjustment.—Adjust the 4th, 8th and 11th dorsal vertebrae. Apply hot compresses over the right side of the abdomen. Give a high rectal enema. The patient should drink large amounts of water. Complete rest in bed is essential.

Diseases of the Pancreas

Acute Pancreatitis

Etiology.—The primary cause of this disease is a disturbance of the innervation to the gland, as a result of which

its functional activity and organic integrity are impaired. The disease occurs in three forms: (a) the hemorrhagic form which is seen most commonly in males of middle life, in alcoholics, and may also be due to the entrance of bile into the pancreatic ducts. (b) The suppurative form, which may result from impacted gall-stones, infectious diseases and trauma. (c) The gangrenous form, which follows the hemorrhagic form in some cases. It may also follow the suppurative form, or result from perforation of a gastric ulcer into the pancreas.

Pathology.—In hemorrhagic pancreatitis the gland is enlarged, and is the seat of hemorrhages and necrosis of the gland-cells. In suppurative pancreatitis one or more abscesses or diffused purulent infiltration is present. In the gangrenous form, the pancreas is converted into a soft, grey mass.

Symptoms.—Symptoms of the hemorrhagic form are sudden onset with colicky pain in the epigastric region, nausea and vomiting, followed by symptoms of collapse. The abdomen is distended; fever and delirium are present. The symptoms of the suppurative form run a more chronic course, and there are periods during which no symptoms are present, alternating with attacks in which the following symptoms are present, in addition to those previously mentioned: The urine contains sugar, jaundice is present, and the stools contain a large amount of fat. The symptoms of the gangrenous form are the same as those mentioned under the other two headings.

Adjustment.—Adjust the 4th, 5th, 6th, or 8th thoracic vertebra.

Chronic Pancreatitis

Etiology.—This disease usually follows the acute form, as a result of the production of reflex subluxations in the segments controlling the pancreas, and which lesions obstruct the outflow of impulses to the pancreas, which are essential to its organic integrity. It also follows obstruction of the pancreatic ducts, by stones, or the extension of an inflammation into the pancreas from the duodenum. It is also sometimes due to syphilis.

Pathology.—The pancreas is increased or diminished in size, and hard.

Symptoms.—The symptoms of chronic pancreatitis are very similar to those of the acute form, but are milder and run a more chronic course. The most characteristic symptoms are jaundice, the presence of sugar in the urine, and fatty stools.

Adjustment.—Adjust the 4th, 5th, 6th, or 8th thoracic vertebra.

Cancer of the Pancreas

Etiology.—This disease is very rare, and the growth is usually primary, and of the scirrhous variety. It is most common to men past middle life.

Symptoms.—The most characteristic symptom is the enlargement of the pancreas which is nodular when palpated in the epigastric region. Other symptoms are jaundice, fatty stools, and glycosuria. In connection with these symptoms there may be present gastric disturbances, a dull pain in the epigastrium, and finally cachexia develops.

Adjustments.—Adjust the 4th, 5th, 6th, or 8th thoracic vertebra. The management is largely symptomatic, and in the main the prognosis is hopeless.

Cysts of the Pancreas

Etiology.—Cysts of the pancreas are usually of the retention variety, that is to say, due to an obstruction to the outflow of the pancreatic juice, as a result of closure of the duct of the pancreas by tumors or calculi. They may, however, also be due to echinococcus or malignant tumors.

Symptoms.—The most characteristic symptom is the presence of an enlargement in the left side of the epigastric region, which is lobular in outline, and resisting. Associated with this condition are jaundice, abdominal pain, digestive disturbances, loss of flesh and strength, and clay-colored stools.

Adjustment.—Adjust the 4th, 5th, 6th or 8th thoracic vertebra. Surgical measures may become necessary.

Pancreatic Calculi

Etiology.—The primary cause of calculi in the pancreas or its ducts, is an obstruction to the outflow of those nerve-

impulses which govern the secretory activity of the glands. As a result of the withdrawal of this innervation, the secretion undergoes changes from the normal, and may contain dried particles, around which salts deposit, forming stones.

Symptoms.—No characteristic symptoms may be present, or there may be colicky pains in the epigastrium, vomiting, fatty stools, and the passage of the stones in the stools.

Adjustment.—Adjust the 4th, 5th, 6th or 8th thoracic vertebra. For the colicky pains, hot compresses may be applied over the epigastric region. During the paroxyms the patient should be placed in bed.

Diseases of the Peritoneum

Acute General Peritonitis

Etiology.—Secondary peritonitis may be due to the extension of the inflammation from one of the abdominal organs, or from penetrating wounds. The most common cause of peritonitis, however, is perforation. Primary peritonitis results from exposure to cold and wet, and may occur late in the course of Bright's disease, arterio-sclerosis, and gout.

Pathology.—There is local and general congestion of the peritoneum. The intestines are distended, and their coils are adhered to one another.

Symptoms.—The onset is very sudden, with a chill, and symptoms of collapse. This is followed by a rapid rise of temperature, and extreme tenderness and pain of the abdomen. The muscles over the affected area are rigid, and the knees are flexed on account of the intense pain. Tympanites and absolute constipation are present. The face has an anxious expression, and is pinched. There is excessive vomiting.

Adjustment.—The adjustments are primarily directed toward the cause. Adjustment should therefore be made in those segments which control the parts involved. Adjust also subluxations of the 1st, 2nd or 3rd lumbar vertebra. Rest in bed and absolute quiet should be maintained. Ice, milk, and champagne may be given, if the stomach is able to retain them. For vomiting, pieces of ice may be dissolved in the mouth. When the peritonitis is due to perforation, surgical measures are necessary.

Ascites (Dropsy)

Etiology.—This condition may accompany the general dropsy which occurs in diseases of the heart, liver and kidneys. It is also due to chronic peritonitis, abdominal tumors, and obstruction of the portal circulation.

Symptoms.—The abdomen is uniformly distended, and globular. The superficial abdominal veins are enlarged. On percussion a flat note is obtained in the most dependent portions, and a change of the position of the patient will cause a variation in the level of flatness. If, while the patient is lying on the back, the lumbar region on one side is slightly tapped, the impulse of the fluid may be felt on the other side. Tympanitic resonance may be elicited on percussion in the epigastric region.

Adjustment.—This must be directed to the primary cause of the dropsy. Adjust the 6th to the 10th thoracic vertebrae, the 10th for its diuretic and diaphoretic effect.

CHAPTER IX

Diseases of the Nervous System

Diseases of the Cerebrum

Meningitis

1. **Pachymeningitis** (inflammation of the dura mater).

Etiology.—This affection exists in two forms: It is called Pachymeningitis Externa when the external layer of the dura mater is first affected; Pachymeningitis Interna, when the inner layer of the dura is first affected. Pachymeningitis externa is produced by injuries of the skull, and is purely a surgical affection. Pachymeningitis interna is due to trauma of the head, Bright's disease, tuberculosis, syphilis, scurvy and alcoholism. It may also result from the extension of a suppurative process from the middle ear. Gout, erysipelas and sunstroke have also been noted as having caused the condition.

Pathology.—The dura mater is first congested, following which it is covered with an exudation which becomes organized into a new membrane, which contains many blood vessels, having thin walls, and from which hemorrhages frequently occur. When the disease is due to syphilis, the dura is covered with gummata, which may degenerate and form caseous masses, or be liquified and converted into pus.

Symptoms.—The characteristic symptoms of this affection are constant headaches, insomnia, dizziness, aversion to light, and impairment of the physical and mental faculties. These symptoms are followed by convulsions, delirium, and coma, or by apoplectiform attacks and paralysis. Epileptic attacks are prone to occur.

2. **Acute Leptomeningitis.**

Etiology.—Acute leptomeningitis is an inflammation of the arachnoid and pia mater, and is often seen in the course of acute infectious fevers. It may follow disease of the cranial bones, or of the middle ear, or be secondary to a tubercular process in some other part of the body. Other

causes may be insomnia, acute alcoholism, sunstroke, syphilis and overwork. The primary form is due to a low grade of resistance of these membranes, rendering them susceptible to the invasion of the exciting form, which is the diplococcus intracellularis. The secondary form is due to the various bacilli which are the cause of the acute infectious diseases which it frequently complicates, primarily induced by a low grade of resistance.

Pathology.—There is at first hyperemia of the pia and arachnoid; this is followed by an exudation of a serous fluid, which later becomes fibrinous and finally purulent. This purulent exudation fills the arachnoid space, and when mixed with the cerebro-spinal fluid, renders it turbid. As a result of the inflammatory process the meninges become thickened, and adhesions are formed.

Symptoms.—The disease may commence very suddenly, but usually the onset is gradual and characterized by malaise, headache, vertigo, irritability, vomiting, rise in temperature, restlessness, and a lack of desire to move about. Following these prodromal symptoms, the disease is initiated by severe chill, and a rapid rise in temperature and increase in the pulse-rate. The eyes are congested, there is violent headache, aversion to light, dizziness, nausea and vomiting, tinnitius, and delirium. The stage of excitation next follows, the characteristic symptoms of which are hyperthesia of the skin, wild delirium, spasms of the muscles, opisthotonos and convulsions. Temperature is high, and the pulse slow and irregular. Intense headache continues. The duration of this stage of the disease may be one day or as long as two weeks.

If the stage of collapse develops, various pressure symptoms, due to the increase of the exudation, develop. The delirium subsides, and the muscular spasms diminish. The patient gradually passes into deep coma.

Adjustment.—The patient should occupy a quiet, well-ventilated room. The head should be elevated, and an ice bag applied to relieve the headache. The diet should be liquid. Adjustment is often impossible, owing to the severe pain which it induces, together with the difficulty in moving the patient. Continued pressure applied on the nerves controlling segments which are painful will sometimes very

speedily overcome the pain and produce sufficient relaxation to admit of adjustment of the atlas or axis. Alternating cold and hot applications over the spine are useful measures.

Cerebral Congestion (Congestion of the Brain)

Etiology.—Congestion of the brain is seen in two forms: when due to fullness of the arterial capillaries, it is known as active congestion; when occasioned by fullness of the venous capillaries, it is known as passive congestion. The most common causes of active congestion of the brain are a decreased amount of blood in other parts of the body, enlargement of the heart, a general plethoric condition, prolonged mental labor, acute alcoholism, excessive eating and drinking, and sunstroke. The usual causes of passive congestion of the brain are pressure upon the veins which convey the blood away from the brain, dilatation of the right side of the heart, and anything which interferes with the venous circulation. Passive congestion is due usually to a subluxation in the upper cervical region, which produces pressure on the vertebral veins. Reflex subluxations, produced by some of the causes above mentioned, often cause active congestion of the brain by their influence on the vasomotor nerves of the cranium.

Symptoms.—The onset may be sudden or gradual. The characteristic symptoms are paroxysmal headaches, ringing in the ears, deafness, amblyopia, contracted pupils, dizziness, irritability, confusion, insomnia, retraction of the limbs, redness of the face, and sometimes in children, convulsions.

Adjustment.—The contributing causes should, in all cases, be eliminated. The patient should be placed in a quiet, well-ventilated room. The head should be elevated, and an ice-cap applied to it, and heat should be applied to the feet. The bowels should be thoroughly cleansed by an enema. Adjust the 1st, 4th and 7th cervical vertebra.

Cerebral Anemia

Etiology.—A diminished amount of blood in the cerebral vessels may be general, in which case it is the result of sudden shock, weak heart action, valvular disease of the heart, general anemia, hemorrhages, wasting diseases, and follow-

ing infectious fevers of a severe nature. The anemia may also be local, in which case it is due to the obstruction of a vessel by an embolus or thrombus.

Pathology.—The brain is of a pale color, and its ventricles are filled with fluid. It is upon the quality and quantity of blood circulating in the cerebral vessels, that the normal functional activity of the brain depends. If, therefore, the entire brain, or any portion of it, is poorly supplied with blood, its function is disturbed.

Symptoms.—The characteristic symptoms of anemia of the brain are headache, which is relieved by lying with the head low, dizziness, fainting attacks, and occasionally convulsions. If the anemia affect only a portion of the brain, those muscles supplied by the affected area will be temporarily paretic.

Adjustment.—The causes of the cerebral anemia must first of all receive attention, and if it is due to a general anemia, adjustments should be directed toward the relief of this condition. The patient should spend a number of hours each day lying down.

Cerebral Hemorrhage

Etiology.—Cerebral hemorrhage, or apoplexy, is due primarily to arteriosclerosis, which is itself due to faulty metabolism, occasioned by impaired innervation. Anything which subsequently tends to raise the blood pressure may cause the rupture of one of these arteries in the brain, and a more or less severe hemorrhage result.

Pathology.—Cerebral hemorrhage occurs most frequently in the region supplied by the central arteries, namely the striate body, optic thalamus, and internal capsule. They occur less frequently in the cerebellum, still less commonly in the pons and medulla, and very rarely on the convexity of the brain, in which case they are known as meningeal hemorrhage.

Symptoms.—In some cases there may be prodromal symptoms, while in other cases the attack occurs without the slightest warning. When prodromal symptoms are present, they include headache, vertigo, irritability, and numbness in the extremities of one side. In a typical case of apoplexy the patient falls suddenly, there is a marked

mental confusion, but not necessarily loss of consciousness in a simple case. There is more or less paralysis on the one side. In a more severe attack the patient falls after having lost consciousness completely; there is sterterous breathing, the face is flushed, the eyes are congested, the eyelids closed, and there is profuse perspiration of the entire body. In cases which end in death, th temperature soon becomes subnormal. In other cases, where death does not occur at once, the temperature gradually rises until it reaches 107 or 108 just before death. In those cases which terminate favorably, the temperature drops gradually to normal.

After a more or less prolonged period, the patient partially regains the use of the limbs, and is able to walk about, although the limbs are stiff, and the joints are painful and swollen. The reflexes are exaggerated on the affected side, but there is no muscular atrophy. If muscular atrophy does take place, as occurs sometimes, it is an indication that a secondary lesion has occurred in the spinal cord. The mentality is slowly and incompletely restored.

Adjustment.—When the patient is seen immediately after the occurrence of the hemorrhage, his clothing should be loosened, and he should be placed in a horizontal position, with the head slightly raised. An ice bag should be applied to the head and a hot pack to the feet. Adjust the 1st and 2nd cervical vertebrae. The various sequelae to apoplexy should be met by proper adjustment, massage, and passive movements.

Headache

Etiology.—Headache is a symptom rather than a disease, and the cause should be looked for in every case. Among the more common causes of pain in the head may be mentioned migraine, neuralgia and neuritis. Remote causes of pain in the head are anemia, hemorrhage, Bright's disease, constitutional diseases, infectious diseases, intoxication, neuroses, fatigue, impure air, acclimation, reflex or referred pain from other parts of the body, and organic diseases of the nervous system.

Symptoms.—The character of the headache is of great assistance in determining the cause thereof. Thus in neuralgia the pain is sharp, lancinating and paroxysmal; in

migraine or hemicrania, the headache is pulsating or throbbing, paroxysmal and unilateral; in gastro-intestinal diseases and infectious fevers, the headache is dull, heavy and general, and is increased by shaking the head; in neurasthenia the headache is binding or pressing; in anemia and rheumatism the headache is a hot and burning pain; in epilepsy and hysteria the pain is sharp and boring. The location of the pain in the head is also of value, in determining the producing cause. Thus a headache caused by anemia is usually frontal; headaches due to hysteria affect the vertex; neurasthenic headaches usually affect the vertex, and sometimes are described as a tight-band about the head; headaches due to catarrh of the nose and throat begin at the root of the nose, and extend directly backward to the occiut, and are greatly increased by coughing and bending forward; headaches due to ocular defects are frontal or occipal; headaches due to constipation or indigestion are frontal and orbital, and are made worse by sudden movements of the head; in headaches due to pelvic disorders, the pain is experienced chiefly on the top of the head, and in the occipital region.

Adjustment.—Primary attention should be directed towards relief of the cause of the headache. Attention should next be directed toward the relief of the headache itself, and this can be accomplished in nearly all cases by adjustment of the 1st and 4th cervical vertebrae.

Diseases of the Spinal Cord

Acute Anterior Poliomyelitis (Infantile Paralysis)

Etiology.—This disease is seen most commonly in children between the ages of one and three years. It occurs most commonly in the summer months. Frequently it follows a prolonged diarrhea, or some of the exanthemata. Its contagious nature seems to indicate that it is of an infectious character, although the exact nature of the producing organism has not as yet been determined. Spinal adjustment is exceedingly beneficial in these cases, and acute subluxations may therefore justly be considered as predisposing causes.

Pathology.—The anterior horns of the spinal cord of the affected segments are congested, and small hemorrhages

into the gray matter of the cord are found. Various degrees of parenchymatous degeneration are present. The ganglion cells are swollen, granular, and their processes are indistinctly seen under the microscope. In post-mortem examinations made some years after the occurrence of the disease, it is seen that the anterior horn is shrunken, and the ganglion cells are replaced by fibrous tissue.

Symptoms.—The onset is usually very sudden, the child going to bed apparently in perfect health, and being found the next morning with some of the extremities paralyzed. Often the disease is initiated by convulsions, and a high fever follows, which is of short duration. The lower limbs are paralyzed more often than the upper. At first for a few hours or days there is extreme pain in the affected limbs, but this subsides. In a week or two most of the paralyzed muscles recover, leaving other groups more or less permanently affected, depending upon the degree of destruction of the ganglion cells in the cord. Any group of muscles may thus remain affected, but the perinei muscles of the lower extremities are most often paralyzed. No sensory disorders are present, but the reflexes are lost. The parts which remain paralyzed soon evidence trophic disturbances, as noted by the atrophy of the muscles, the coldness of the surface, and the poor circulation. In many cases the atrophy of the muscles becomes extreme, and as a result of this, various deformities occur. As the child grows older, the paralyzed limb, if left untreated, does not develop as does the healthy one, and the bones are shorter and smaller in the affected limb than in the healthy one.

Adjustment.—A careful and searching spinal analysis must be made, paying especial attention to the segments which govern the paralyzed muscles. Subluxations should be adjusted every other day, and if persisted in, it will be followed by almost complete recover, in all cases, and total cure in most cases. The diet, hygiene, and the general health of the patient must be carefully attended to.

Locomotor Ataxia (Tabes Dorsalis)

Etiology.—Locomotor ataxia is a degeneration of the posterior column and posterior nerve roots of the spinal cord, and is considered in every case a manifestation of or the

third stage of syphilis. Contributing causes such as alcoholism, exposure, hardship, and injuries have some influence in its production.

Pathology.—The disease process affects both the central and the peripheral nervous system. The principal lesions are located in the sensory tract of the spinal column and in the ganglia and roots of the posterior columns of the cord. The optic nerve is especially affected, and this is considered due to the fact that the optic nerve is really an extension of the cerebral substance. The morbid changes generally commence in the dorso-lumbar portion of the cord, and are most marked in that region.

Symptoms.—Symptomatically the disease is divided into two stages: First, the prodromal stage; second, the ataxic stage. The symptoms of the prodromal stage are divided into the subjective symptoms and the objective symptoms.

The subjective symptoms which are characteristic of the prodromal stage are lightning pains in different parts of the body, especially the lower limbs. Following the pain, abnormalitis of sensation appear, which may consist of itching, numbness, or a sensation in the feet as though the patient were walking on a thick pad of cotton. The most characteristic disturbance of sensation, however, is the girdle sensation, which is a feeling of constriction about the waist as though a tight band were drawn around it. There is a feeling of weakness or uncertainty in the lower limbs. Slight bladder and sexual disturbances are present. Any of the following ocular disturbances may be present: Squint, double-vision, or impaired vision; optic atrophy commences early in the disease in many cases, and is the first thing to draw the patient's attention to his condition.

Objective symptoms which are present in the prodromal stage are Romberg's sign, which is a symptom of incoördination, and is shown by swaying of the patient on standing with the eyes closed. The Argyll-Robertson pupil is present. The knee-reflex is lost. Sensibility to temperature and pain is diminished. The space sense is interfered with, the muscle sense is retained, and the sense of touch is not greatly affected.

The ataxic stage is characterized chiefly by the presence of motor symptoms, which are not due to involvement of

the motor tract of the cord, but are due to incoördination. The characteristic symptom is the ataxic gait. Incoördination of the muscles becomes more and more marked, and the sensation of posture and position of the limbs entirely disappears. Crises of pain occur in all cases, the gastric crises being diagnostic. Disturbances in micturition and defecation and loss of sexual power may occur early or late in the disease. The patient's condition is finally terminated by paralysis, or death is a result of an intercurrent affection, most commonly pneumonia.

Adjustment.—Adjust the 1st and 2nd cervical vertebrae, the upper dorsal, and the lumbar vertebrae. A careful spinal analysis should be made in every case, to determine the existence of subluxations, and these may vary in their occurrence. Apply pressure for about one minute upon those nerves which supply affected parts, for the relief of the various forms of crises. In the ataxic stage, traction from two to five minutes every day is a valuable measure. In all cases, the patient should be confined to bed for a long period of time. He should be removed from all excitement, mental exertion, and worry. By all means, as a well regulated diet, attention to the eliminative organs, and general hygienic measures, the health of the patient should be improved as much as possible. Massage and systematic exercises are very beneficial, and should be applied in all cases. During the ataxic stage the patient should practice exercises which will restore the power of coördination. Many methods of doing this are used, and the attendant may use any system or method which seems suitable to the case.

Acute Myelitis (Transverse Myelitis)

Etiology.—Inflammation of the substance of the spinal cord may be due to exposure to cold and wet, injuries of the vertebrae or subluxation thereof; or it may occur as a sequel to puerperal fever, typhoid fever, syphilis, rheumatism, eruptive fevers, and intoxications. It may also be a sequel to congestion of the spinal cord, or spinal meningitis.

Pathology.—The inflammation of the spinal cord may affect the gray or the white substance; it may be limited to

certain sections of the cord, or affect the entire cord. The progress of the inflammamiton may be in an upward direction, or downward, or transversely. The nerve structures of the cord undergo fatty degeneration, and softening of the cord may occur.

Symptoms.—The disease usually commences very suddenly with a chill, and rapid rise in temperature, and changes in motor and sensory function. The back is exceedingly sensitive, there is paresthesia of the limbs, or even complete anesthesia. The girdle sensation, namely, a feeling as though a tight band were drawn about the waist, is a characteristic symptom of this condition. As early as the first day, paralysis of the lower limbs, and the bladder and bowels occurs. The knee-jerk is absent, as are all the other reflexes of the lower extremities. The muscles atrophy, and the temperature of the affected limbs is lowered. During the acute course of the disease, symptoms common to all acute disorders, such as gastrointestinal disorders, irregularity of the heart, dyspnea, and difficult swallowing are present. Bed-sores are prone to develop. The urine is alkaline in reaction and cystitis finally develops.

Adjustment.—The patient should be placed in bed, and absolute rest enforced. The patient should be sponged several times a day, and the shin dusted with talcum to prevent the formation of bed-sores. In cases where the urine is retained, the catheter should be used. Nerve pressure along the spine is very useful to relieve the tenderness. A careful spinal analysis should be made, and subluxated vertebrae should be corrected as found.

Bulbar Paralysis

Etiology.—Bulbar paralysis is a gradually increasing paralysis of both sides of the tongue, lips, palate, pharynx and larynx, due to a degeneration of certain nuclei in the medulla oblongata. The cause of the degeneration is an injury in the upper part of the neck, whereby the atlas and axis are misplaced. In the young adult, however, such a misplacement will not produce bulbar paralysis, since the disease is seldom seen before the 40th year of life. Contributing causes are syphilis, gout and rheumatism.

Symptoms.—The disease commences very slowly, the

first symptoms being difficulty in speech, owing to the lack of control of the movements of the tongue; this becomes more and more pronounced, until finally the tongue is completely paralyzed. From here the paralysis extends to the muscles of the pharynx and the soft palate, causing dysphagia. Next the orbicularis oris becomes paralyzed, and prevents the closing of the lips. Finally the muscles of the larynx are paralyzed and speech is completely lost. As the paralysis of the lips and tongue becomes progressively more pronounced, atrophy of the muscles sets in. As the degenerative processes in the medulla increase, the nucleus of the vagus nerve becomes affected, and cardiac and respiratory disturbancs develop. The inability of the patient to swallow and thus obtain nourishment, together with the deficient respiratory activity, causes marked impairment of the health.

In addition to the chronic form just described, there are two other varieties, one caused by hemorrhage or the medulla, and the other by an inflammatory condition. Their symptoms are the same as those of the chronic form, but their onset is acute.

Adjustment.—Adjust the upper cervical vertebrae. Otherwise the care is symptomatic.

Amyotrophic Lateral Sclerosis (Primary Lateral Sclerosis: Spasmodic Tabes Dorsalis

Etiology.—This disease, which is a degenerative process in the lateral columns of the spinal cord, is seen chiefly in men between the ages of 30 and 50 years. The exact mode of production of this condition is due to a want of proper innervation of the affected segments of the spinal cord themselves, as a result of which the metabolic processes in the cord are deranged.

Pathology.—The morbid process is limited usually to the lateral columns of the spinal cord, and the anterior horns are the ones affected. There is gradual wasting or degeneration of the ganglion cells, and an infiltration of fibrous connective tissue occurs, sclerosis of the lateral column of the cord finally developing.

Symptoms.—The disease commences very gradually, and almost at the same time in both the upper and lower

extremities. There is first a sensation of weakness and weight in the limbs; this is followed by spasms of the muscles of the limbs, with stiffness. These spasms become more pronounced as the disease progresses. The knee reflex is greatly exaggerated, and rectus clonus and ankle clonus are present. Sensation is undisturbed, and the bladder and rectum are not affected.

Adjustment.—Adjustment should be made wherever indicated after a careful spinal analysis has been made. Warm baths daily should be given. The patient should refrain from all mental and physical work, and the general health should be improved in every possible way.

Progressive Muscular Atrophy (Wasting Palsy)

Etiology.—Combined wasting and paralysis of certain sets of muscles is seen most commonly in men between the ages of 30 and 50 years. Its occurrence is contributed to chiefly by syphilis, lead poisoning, acute infectious diseases and exposure.

Pathology.—There is atrophy and degeneration of the anterior columns of the spinal cord, and a degeneration of the ganglion cells. There is a wasting of the muscular tissue and a replacement thereof by fibrous connective tissue. This continues until the muscle is converted into a fibrous band containing a large number of fat cells.

Symptoms.—The disease commences very insidiously. There are first fine contractions of the muscles, which are very sensitive and respond to such slight stimulation as a draught of air. The disease process is usually confined to one of a number of groups of muscles, most commonly those of the upper extremities. The first noticeable symptom is a gradual wasting of the muscle, which is accompanied by increasing weakness of those muscles, together with paresthesia, pallor and coldness of the skin over them. The atrophy of the muscles is so extreme that the bones remain practically uncovered except by skin. Various forms of the disease are recognized, depending upon the particular group of muscles which is affected.

Adjustment.—Make adjustments in those segments from which the affected groups of muscles derive their innerva-

tion. Rest and attention to the general health are measures which should not be overlooked.

Ataxic Paraplegia

Etiology.—Chronic degeneration of the lateral and posterior columns of the spinal cord occurs principally in persons of advanced age, whose life has been one of hardships. Among the contributing causes may be mentioned syphilis, heredity, anemia, and various forms of intoxications.

Pathology.—There is a sclerosis of the posterior and lateral columns of the spinal cord similar to that which occurs in tabes dorsalis, except that the lesions are limited principally to the dorsal portion of the spinal cord, rather than to the dorso-lumbar section.

Symptoms.—The disease commences very gradually, the first symptom noted being a loss of power in the lower extremities, together with pain and stiffness. Ataxia is present as shown by the swaying when the patient stands with the feet close together, and the tendency to fall when he stands with the eyes closed. The knee-jerk is increased. Spasms of the lower limbs occur. There are no shooting pains nor eye symptoms, nor is sensation impaired, as is the case in locomotor ataxia. Incontinence of urine and feces is, however, frequently noticed.

Adjustment.—The adjustment of this affection is, in general, the same as that given in the case of locomotor ataxia, and amyotrophic lateral sclerosis.

Hereditary Ataxia (Friedrich's Ataxia)

Etiology.—This disease affects persons during the first 20 years of life, and is seen most commonly in families, which indicates that it is hereditary.

Pathology.—There is defective development of the spinal cord, since post-mortem examinations show the cord to be smaller than normal. There is a degeneration and atrophy, together with disappearance of the ganglia in the posterior columns of the spinal cord.

Symptoms.—The characteristic symptoms of this condition are ataxia, and paraplegia, which produce an uncertain gait. The speech is scanning and uncertain. Vision is impaired. Reflexes are unchanged or diminished. Sensory

symptoms are never present. Scoliosis and deformities of the feet are often noticed.

Adjustment.—The adjustment given for locomotor ataxia is applicable in this disease.

Multiple Sclerosis (Cerebro-Spinal Sclerosis; Disseminated Sclerosis)

Etiology.—This disease is seen between the ages of 15 and 40 years, and is due to injuries. Sometimes it follows acute infectious diseases, and has also been accompanied by a previous history of syphilis, tuberculosis and malaria.

Pathology.—Spots of sclerosis are found throughout the extent of the brain and spinal cord. These spots vary in size from a pinhead to a nut, and consist of degenerated nerve tissue and connective tissue. Pressure of the nodules upon the nerve structures of cord result in degeneration thereof.

Symptoms.—The condition develops slowly, and the symptoms indicate the location of the lesion. Characteristic symptoms are impaired vision and nystagmus, speech disturbances, headache, vertigo, and epileptiform seizures. Later a tremor of the extremities appears, the reflexes are exaggerated, and stiffness and contracture of the limbs develop. Later the gait becomes spastic, and finally complete paralysis occurs, the legs remaining extended and rigid.

Adjustment.—Make adjustments in those segments which control the parts affected.

Syringomyelia

Etiology.—The characteristic feature of this disease is the occurrence of cavities in the substance of the spinal cord, the exact mode of production of which is not definitely known. The affection is seen during the first half of life, and follows injuries of the cord most frequently. Undoubtedly subluxation of vertebrae contribute to the production of the disease by reducing the blood supply of the cord.

Pathology.—The morbid lesions are confined principally to the cervical portion of the spinal cord. The production of the cavities has been explained in two ways. The first theory is that there is faulty development of the central canal of the cord, in which there is only a partial closure of the primary central canal of the cord in the embryo. The second theory is that the cavities are produced by the de-

generation and absorption of gliomatous substance in the substance of the cord.

Symptoms.—The disease commences very slowly, the first symptoms usually being a diminution or absence of the pain and temperature sense, while the touch sense is intact. When the anterior columns of the cord are affected, atrophy of the muscles occurs, and most commonly affects the muscles of the arms and shoulders, being generally bilateral. The atrophy of the muscles is accompanied by weakness, and when the weakness affects the muscles of the spinal column, scoliosis follows. In like manner the skin is affected by trophic changes, which may progress to gangrene.

Adjustment.—Make adjustments indicated by the spinal analysis. Attention to the general health and adjustment for symptoms as they arise, are required.

Caisson Disease

Etiology.—This condition is seen in individuals who work under increased atmospheric pressure, such as divers, and those engaged in the construction of tunnels, subways, and the foundations of large buildings. Subluxations in the upper cervical spine act as a predisposing cause.

Symptoms.—The symptoms generally occur when the individual returns to the surface atmosphere, and include headache, dizziness, ringing of the ears, and mild prostration. The more severe symptoms which may follow are various forms of paralysis, loss of sensation, and epileptiform seizures.

Adjustment.—The essential is prevention, and consists in persons engaged in work of this nature to return to the surface gradually, so as to accustom themselves to the change in the atmospheric pressure. Sequelae should be managed as they arise. Adjustments should be made according to indications.

Diseases of the Peripheral Nervous System

Simple Neuritis

Etiology.—The primary and predisposing cause of inflammation of the nerve trunks is impingement of the nerves by a subluxated vertebrae. Among the principal contributing or exciting causes may be mentioned injuries,

exposure to cold and wet, alcoholism, gout, rheumatism, syphilis, lead-poisoning, and infectious diseases.

Symptoms.—The characteristic symptoms of this affection is intense pain and tenderness along the cords of the nerve and its main branches; the pain resembles that of a toothache, and is increased by movement or by pressure. If the nerve, in addition to being sensory, is a motor nerve, contraction and spasms of the muscles occur, followed by partial paralysis. The muscular and temperature sense are very little impaired, but the touch and pain sense are decidedly affected. At times degeneration of the nerve trunk follows, and in such cases there is atrophy and degeneration of the muscles supplied by this nerve.

Adjustment.—Make adjustments in the segments which control the affected parts, and subluxations will always be found affecting the nerve. The affected part should be placed at rest, and after the acute symptoms have subsided adjustments should be continued for some time to completely regenerate the nerves and repair the tonicity of the affected muscle.

Multiple Neuritis

Etiology.—Inflammation of a number of nerves may be caused by a great variety of poisons, chief of which are alcohol, lead, arsenic, and mercury. It also accompanies nearly all the acute infectious diseases. Frequently it is seen in syphilis, diabetes, rheumatism, gout, and chorea. It is seen in women much more commonly than in men, and occurs between the ages of 30 and 50.

Symptoms.—The disease usually commences slowly, and runs a chronic course. The characteristic symptoms of multiple neuritis due to lead poisoning are the fact that it occurs in chronic lead poisoning, and that the symptoms of this condition, namely, a blue line on the gums, anemia, and lead colic are present. The radial nerve is principally affected, and wrist-drop is a constant symptom. No sensory disturbances are present.

The characteristic symptoms of multiple neuritis, due to alcohol poisoning are the facts that there is always a history of chronic alcoholism; in this form the neuritis is very generally distributed over the body; the result of the

affection in the lower extremities are foot-drop, atxaia, uncertain gait, paralysis of the muscles, tenderness of the calf muscles. The disease is not so severe in the upper as in the lower extremities, both of which are, however, affected in every case. Tenderness of the nerve and nerve pain are present, and occur before paralysis develops. All forms of sensory disturbances are present. The reflexes are absent in the paralyzed muscles, and edema of the ankles very often occurs. Mental disorders frequently accompany this form of multiple neuritis.

The characteristic symptoms of multiple neuritis due to arsenic poisoning are marked gastro-intestinal disturbances for some time preceding the actual occurrence of the inflammation of the nerves. As in alcohol neuritis, the legs are more affected than the arms, though to a greater degree. Various disturbances of sensation, atrophy and paralysis, and pain are present.

Adjustment.—In all cases attention should first be directed to the relief of the exciting cause. Absolute rest in bed is necessary and the affected limb should be wrapped in hot compresses. The diet should be nourishing and non-stimulating. Adjustment should be made in those segments controlling the affected parts.

Neuralgia

Etiology.—The primary and predisposing cause of neuralgia is a subluxation of a vertebra which produces an impingement of the nerve transmitted through the corresponding intervertebral foramen. The contributing or secondary causes are exposure to cold and damp, injuries of the nerve trunks, reflex disturbances, mental overwork and anxiety. The condition frequently accompanies syphilis, rheumatism, gout, intoxications, anemia, and malaria. It is seen ordinarily in adult life, more frequently in women than in men, and heredity seems to have some influence in its production.

Symptoms.—There are a number of varieties of neuralgia which are classified according to their location. The most common forms of these local neuralgias are the following:

Trigeminal Neuralgia, or Tic douloureux, is a neuralgia

of the 5th cranial nerve, and is one of the most severe and obstinate of all neuralgias. Pains are intense and darting, and unilateral. Paroxysms usually last for a few minutes, followed by partial remissions. There are convulsive twitching of the muscles of the side of the face affected. There is tenderness at the supra-orbital and infra-orbital foramina, and along the course of the nerve.

Cervico-occipital Neuralgia consists of a sharp, spasmodic pain, which may be unilateral or bilateral, and extends from the top of the head down the neck as far as the clavicle, and then forward and upward to the sides of the face. The skin over the affected area may be very sensitive, contractions of the cervical muscles may occur. In many of these cases a clicking sound in the back of the neck is complained of.

Cervico-brachial Neuralgia is a lancinating or burning pain, and tenderness along the nerves forming the cervical and brachial plexuses. There is numbness and weakness of the shoulder, arm, scapula and breast.

Intercostal Neuralgia is a paroxysmal pain occurring most commonly in the 5th and 6th intercostal nerves. The condition is distinguished from pleurisy by the three characteristic points of tenderness, namely, at the exit of the nerve from the spinal foramen, at the greatest covexity of the rib, and at the sterno-costal articulation. This form of neuraligia is frequently accompanied by herpes, zoster, or shingles.

Lumbo-Abdominal Neuralgia, is a paroxysmal pain of a lancinating character along the inner side of the thigh, the hip and the scrotum.

Sciatica is a paraxysmal lancinating pain along the thigh, calf, ankle and heel.

Coccygodynia is a paroxysmal, boring pain experienced during walking and sitting alike, and felt over the end of the spine. It is a result commonly of perineal laceration or pelvic diseases.

Tarsalgia is a variety of neuraliga which affects the soles of the feet, and is seen in those who are obliged to be on their feet a great deal of the time. It is frequently accompanied by flatfoot.

Adjustment.—The vertebrae corresponding to those spinal segments which control the affected parts, or from

which the nerves are derived should be adjusted. In all cases the occurrence of contributing causes should be carefully investigated, and corrections made as indicated. The general health should be given careful attention.

Facial Paralysis (Bell's Palsy)

Etiology.—Paralysis of the 7th cranial nerve is caused by exposure to cold, disease or injury of the middle ear, disease of the nucleus of the 7th nerve, or in the cortex or base of the brain; also by rheumatism, syphilis, and infectious diseases. Subluxations in the upper cervical spine are a predisposing cause by reason of the intimate connection between the superior cervical ganglion and the 7th nerve.

Symptoms.—The characteristic symptoms of paralysis of the facial muscles are want of expression, all wrinkles being smoothed out, and the mouth is drooped, and drawn toward the unaffected side. The eye-lids do not cover the eye-balls entirely; the patient is unable to whistle, to show the teeth, or to inflate the cheek of the paralyzed side. The mouth is dry, due to a diminution in the quantity of saliva, and there is disturbance of the sense of taste of the anterior two-thirds of the paralyzed side of the tongue. In some cases hearing is hyper-acute. No sensory disturbances are present.

Adjustment.—Adjust the 1st and 4th cervical and the upper dorsal vertebrae. In the acute stages of the affection the bowels should be kept open and free action of the skin maintained.

General Nervous Diseases

Epilepsy

Etiology.—In nearly all cases of epilepsy a pronounced neurotic family history may be obtained. The disease is seen most commonly during the first half of life, and commences ordinarily between the ages of 10 and 20 years. The most common exciting causes are any form of peripheral irritation, thickening or adhesions of the meninges, mental worry, anxiety, fear and depression, syphilis, and uterine diseases. Frequently the condition can be traced to an injury, and subluxation of the vertebrae may be the cause in some cases, as attested to by the fact that adjustments sometimes relieve the condition. In all cases of epilepsy con-

stipation is a constant feature and may be an important predisposing cause.

Symptoms.—Epilepsy is classed in two forms: Petit Mal, in which the disease is very mild, and Grand Mal, in which the attacks are severe.

The attack comes on suddenly and without forewarning, the patient falling where he stands, and being unable to make any efforts to protect himself. Sometimes a characteristic cry is uttered before the patient falls. Convulsions then occur, which at first are tonic and later become clonic. During the attacks there may be frothing of the mouth, due to the forcible passage of air through the narrow opening between the teeth, and the tongue may be bitten. The convulsions continue for several minutes, and are followed by unconsciousness. During the stage of coma the face becoms cyanotic, and turned to one side. The pupils are dilated, and do not react. The pulse is increased in frequency; the respiration is first diminished and then becomes snoring; the temperature is slightly raised.

Adjustment.—Every case of epilepsy should be carefully studied with a view to determining the exact cause. Some case respond to vertebral adjustment, a complete cure resulting; others are only improved; still others are not affected at all. In those cases in which the disease is due to some peripheral irritation, correction of this exciting cause will help. A careful spinal analysis should be made in every instance, and the subluxations which are found should be corrected. Adjustment of the atlas and axis, the 4th cervical and the upper dorsal and upper lumbar vertebrae are especially indicated. Coccygeal adjustment has also been recommended in these cases. The general health should receive attention, and proper diet of a non-stimulating character prescribed. If the patient is seen during an attack, the clothing should be loosened, an object should be placed between the teeth to prevent biting of the tongue, and he should be left in a comfortable position.

Hysteria

Etiology.—This disease is best defined by Möbius as being "A State in which ideas control the body, to produce

morbid changes in its function" (Osler). It is a condition peculiar to our present civilization, and is seen in young girls, unmarried women, widows, and childless married women. Manifestations are seen most commonly during menstruation, and during the menopause. Exciting causes are powerful emotions, especially those of a painful nature, such as fear, sorrow, etc. Predisposing causes are faulty innervation due to a multiplicity of spinal lesions, in connection with injuries, infectious fevers, mercury, tobacco, and all forms of toxic irritants.

Symptoms.—The disease is seen in two forms: Hysteria minor and hysteria major. Hysteria minor generally attacks girls or young women who are of an emotional nature. The first symptoms which manifest themselves are a morbid sensitiveness, inability to control the emotions, great depression of mind, nervousness, etc. The patient becomes alarmed at trifles, and as a rule there are headaches, and pains along the spine. There may also be attacks of vomiting and sometimes the hysteria is so severe as almost to amount to actual delirium. In aggravated cases when the patient is of an intensely emotional nature, there may be present a mental condition in which the patient says and does things of which afterwards there is no consciousness. The "cries" emitted during the hysterical crisis are sufficient to distinguish it from neuresthenia or mere nervousness. Unless properly treated, this minor form of the malady may be perpetuated and develop into the major form. Between the paroxysms of hysteria major, there are present contractures, paralysis, tremors, and anesthesia, as well as a disturbance in the mental functions. There are also attacks of vomiting, severe pains, hysterical coughing, sneezing, and labored respiration. The patient loses all control of the emotions, and laughs and cries excessively and without any reason. Very frequently there are paroxysms of anger, with great excitation, and accompanying these manifestations there is a feeling as if there were some substance in the throat producing a feeling of squeezing or compression (Globus Hystericus). An excessive discharge of urine follows the crisis. Convulsions occur only in the major forms of hysteria; it is really epileptical in nature, as its name implies (hystero-epileptic). These attacks

are quite severe, and manifest themselves as follows: The patient suddenly falls, and the legs and arms are thrown about in a wild, irregular manner; the head is rolled from side to side; the body is rolled from side to side, and in very severe attacks the patient flexes the fingers and extends the feet; there are also abnormal conditions of the eyeballs and the eyes are generally closed. During the seizure the patient may bite the lips, but does not, as in true epilepsy, bite the tongue, nor do herself any serious injury during the attack. The attacks may last from half an hour to several hours. In some cases of hysterical convulsions there may be merely a shaking of the body, as in a chill; in others, the attacks may manifest themselves in a rigidity and rhythmical swaying of the body, movements of the arms, and incoherent noises. During these attacks the patient is, in a great measure, conscious of her surroundings, and very often can be beneficially acted upon by suggestions from those around. In the case of children, the attacks are often accompanied by peculiar noises, the patient imitating the bark of a dog, and similar sounds.

Besides these motorial symptoms, there are also sensory symptoms, such as hyperthesia of the skin and the mucous membranes, and also disturbances in the organs of special sense. The permanent optic disturbances of hysteria are loss of color sense, which is either entirely lost or at least greatly impaired; the vision is also impaired, and in some cases eyesight is totally lost. The hearing is also affected; in some cases hearing by aerial conduction may be normal, while hearing by bone conduction may be greatly impaired or entirely lost. There may also result abnormalities in the sense of taste and also in that of smell. Although true neuralgia is not often associated with hysteria, yet hyperesthesia and different kinds of pains are of common occurrence. In women the most prominent hyperesthetic points are over the region of the ovaries, and in men on the corresponding area (the scrotum). The motor symptoms which are associated with hysteria are contractures, tremors, paralysis, and choreic and ataxic movements. These paralyses may be either hemiplegic, monoplegic, or paraplegic. Hemiplegia, associated with hysteria, can easily be distinguished from the hemiplegia due to organic disease,

by the gait of the patient. In true hemiplegia, or that form which is the result of organic disease, the patient invariably swings his leg, while in the hysterical he drags the affected leg after him. Hysterical hemiplegia is usually accompanied by anesthesia of the affected region. Paraplegia is not uncommon among the permanent effects of hysteria, and may or may not be accompanied by pain of a very severe nature. Permanent disturbances of the sphincters is not common, and when it does occur, can generally be traced to some other complicated conditions. There is another peculiar condition of frequent occurrence in the interparaxysmal stage of hysteria, and which is known as amyastenia, or a temporary loss of power in the arm or leg. It is not confined to a single group of muscles, but affects the entire member.

Adjustment.—Adjust the atlas, axis, upper dorsal and lumbar vertebrae. A cold douche to the abdomen or spine will frequently terminate a paroxysm. Further than this nothing need be done for the hysterical attack. The supervision of patients suffering from hysteria must be confined in the first place to an attempt to discover the cause of the condition. It is very often difficult to do this, and hypnotism has been suggested as a means of eliciting the desired information. Suggestive therapeutics are probably the best method in cases of this kind, although their effects are usually temporary only. Daily tepid baths are useful not only for their effect in improving the general health, but also for their sedative effect. Attention to diet, exercise, and general hygienic measures is necessary.

Neurasthenia

Etiology.—In every case of neurasthenia a great diversity of subluxations are constantly present. Contributing causes are a neurotic temperament, overwork, both mental and physical, sexual excesses, and chronic diseases. Heredity plays an important part in the production of this condition, and excessive use of alcohol and tobacco also are a contributing cause.

Symptoms.—The characteristic symptoms of true neurasthenia are insomnia, general weakness, restlessness, inability to concentrate the mind, or do physical work of any

kind, increase the sense of pain, headaches, and expression of anxiety on the face, imaginary ailments of all kinds, and exaggerated reflexes.

Adjustment.—A careful spinal analysis should be made, and all subluxations found should be corrected. Special attention should be paid to the 1st, 2nd and 4th cervical, the 4th and 6th dorsal, and the 2nd lumbar vertebrae. The patient should have a change in surroundings, rest, good diet, and attention to the mental condition. Much can be accompanied by attention to the last mentioned condition through suggestion to the patient of the needlessness of their fears, and encouraging them. The causes which have brought on the condition should be removed.

Chorea (St. Vitus' Dance)

Etiology.—Chorea is seen most commonly in children, and girls are affected more often than boys. The primary and predisposing cause in the large proportion of cases is a lowering of the general vitality, dut to subluxation of vertebrae. Contributing causes are fright, overstudy, lack of fresh air and exercise, auto-intoxication, and sometimes following infection.

Symptoms.—The characteristic symptoms of chorea are involuntary, jerky, spasmodic irregular movements, of various groups of muscles, usually affecting the arm first. The muscular twitchings in the face and tongue give rise to a great variety of facial grimaces. The overactivity of the muscles finally renders them weak and partially paralyzed. The memory is affected; there is irritability, and violent temper may be shown at times. Diseases of the heart, especially valvular lesions and endocarditis are common in this affection.

Adjustment.—The first essential consists in removing the cause whenever it can be found. If the child is in a poor state of general health, measures should be taken towards improving the health. The bowels should be regulated, a generous diet should be prescribed, and the child should be kept in the fresh air as much as possible. In all cases the heart should receive careful attention, and unless it is affected, the child should be encouraged to take a great deal of exercise. Cold sponging every morning and evening

is also a very useful measure in this condition. Coccygeal adjustment has been used with good success in chorea also. The classical procedure in this condition is adjustment of the 1st cervical, the 3rd and 6th dorsal, and the lumbar vertebrae. Other subluxations may, however, exist, and a careful spinal analysis should be made in all cases. In a large percentage of cases, spinal adjustment alone is effective in curing this condition in a very short time.

Tetany

Etiology.—This disease is primarily due to aggravated subluxations, such as those produced by traumatism. Contributing causes are chiefly an insufficient function of the parathyroid glan, emotion, hysteria, and following some of the infectious fevers. It is seen most commonly in young adults of a nervous temperament, and in children suffering from rickets.

Symptoms.—The characteristic symptoms of this affection are spasmodic contractions of the muscles, closely resembling epilepsy, during which the hands are strongly flexed, the arms are drawn upward, with the elbows flexed, and the legs markedly extended. These paroxysms last from a few minutes to a number of hours. They may occur once an hour, or an entire day may intervene between them.

Adjustment.—A careful spinal analysis should be made, and subluxations corrected wherever found, paying especial attention to the segments controlling the regions which are affected by the spasmodic contraction. The general health of the patient should receive careful attention.

Paralysis Agitans (Shaking Palsy)

Etiology.—This disease is seen most commonly in women, after the age of 50 and some persons are undoubtedly predisposed to the affection by subluxations in view of results sometimes obtained by adjustments.

Symptoms.—The onset is gradual, and the first symptom noted is a tremor in one of the hands, especially the right one, following which the arm and leg of the same side are affected. The limbs of the other side then become affected in the same order, and the tremor finally becomes general. The tremor is a slow, rhythmic oscillating movement, and

the attitude of the hand has been compared to pill-rolling. There is a general rigidity of the muscles which is shown by the stolid, mask-like expression of the face, and by the peculiar gait, which results from the stiffening of the muscles of the entire body, so that the trunk is bent forward, and the body moves slowly, as though composed of one piece. The sensations are not disturbed, as a result, although there may be sensations of heat and burning at times.

Adjustment.—Adjustments should be made in those segments from which the innervation of the parts affected is derived. Attention to the general health is necessary and mental and physical exertion should be prohibited.

Occupation Neuroses

Etiology.—Pain and cramps of certain groups of muscles as a result of over-use, are seen most commonly in persons of a neurotic history. The most common example is Writer's cramp. Subluxations act in most cases as a predisposing cause.

Symptoms.—There is first a stiffness of the affected muscles, followed by a feeling of weight and weakness, and lastly the development of spasmodic cramps and contraction. There may be paresis and atrophy of the muscles late in the condition.

Adjustment.—In all these cases the affection soon produces reflex subluxations in those segments from which its innervation is derived, and subluxations should be corrected. The affected members should be placed at rest, and general rest of the patient is also advisable. During this time he should be placed upon a liquid diet, and attention given to the neurotic element of the case.

Mental Diseases

For a description of mental diseases, the reader is referred to works on Psychiatry. Few of these diseases are amenable to treatment of any kind, although there are cases reported in which adjustments relieved mental aberration, but whether it was a true insanity or not is questionable. These are also cases on record, in which rectal dilatation was effective in restoring normal mentality. It must be remem-

bered that certain cases of insanity tend toward a spontaneous cure, and whether anything was done for their relief proved effective or not, is consequently open to question. In the author's opinion, a true, well-developed case of insanity is incurable. There is, however, in this, a fertile field for valuable research work, and it is to be hoped that the future will bring to light positive evidence of restoration of the mental faculties by spinal adjustments.

CHAPTER X

Diseases of the Blood and Ductless Glands

Diseases of the Blood

Anemia

Etioloy.—The primary cause of this disease is disturbed innervation of the blood-forming organs, as a result of subluxations which are reflexly produced through various predisposing causes, among which may be mentioned the following: Hemorrhage, discharges, imperfect nutrition, excessive nursing, chronic intestinal catarrh, wasting diseases, unhygienic surroundings, deficient food, excessive mental and physical work, and pregnancy.

Pathology.—The blood is light in color, owing to the reduction in the amount of hemoglobin and in the number of red corpuscles. It is also considered by some that coagulation is slow.

Symptoms.—The characteristic symptom of secondary anemia is the proportion of decrease in the number of red corpuscles to the diminution in the amount of hemoglobin. Other symptoms present are pallor of the skin and mucous membranes; malaise; loss of flesh and strength; headache; irritability, vertigo, fainting, hysteria, and convulsive attacks; anorexia, nausea and vomiting; constipation or diarreha; low blood pressure; rapid heart action; rapid respiration and dyspnea; edema of the ankles; cold hands and feet; rapid and feeble pulse.

Adjustment.—The first essential is the removal of the cause. In connection therewith a nutritious diet, exercise, fresh air, sunlight, and rest should be prescribed. Make adjustments as indicated in the 5th dorsal region, for stimulation of the blood-forming organs. Remove the cause which may be present in each individual case, and attend to the symptoms as they arise.

Chlorosis (Green Sickness)

Etiology.—The primary cause of this disease is subluxations, which interfere with the conduction of the nerve-impulses necessary to the functional activity of the blood-forming organs. Contributing causes are overwork, impure air, improper food, puberty, female sex, menstrual disorders, heredity, change of climate, and constipation.

Pathology.—The decrease in the number of red blood corpuscles is very slight, but there is a decided decrease in the amount of hemoglobin. There is very little loss in weight. No morbid changes in the bone marrow, lymphatic glands, or spleen are present.

Symptoms.—The characteristic symptom of this condition is a greenish yellow tint of the skin. Other symptoms present are edema of the ankles and eyelids, palpitation of the heart, faintness, ringing in the ears, murmurs in connection with the heart sounds, dyspnea, cold hands and feet, diestive disturbances, headache, and menstrual disorders.

Adjustment.—Adjust the 1st cervical and the middle dorsal vertebrae. Make any other adjustments which may be indicated after a careful spinal analysis has been made. Hygienic measures are an essential in this condition. The bowels, kidneys and skin should be kept well regulated. Well regulated exercises. Careful attention to the diet, which should be highly nutritious. Beyond this the adjustment should be directed to the correction of any causes, and symptoms should be taken care of as they arise.

Pernicious Anemia

Etiology.—The primary cause of this disease is a profound disturbance in the innervation of the blood-forming organs, especially the bone-marrow. Among the predisposing causes may be mentioned syphilis, pregnancy, mental worry and anxiety.

Pathology.—The blood is thin, pale and scanty. The red corpuscles are diminished in number and in the quality of their hemoglobin, and show changes in their form. There is no increase in the white cells. The bone marrow is markedly changed in character. Various organs and muscles degenerate. There is not much emaciation, but there is present extreme weakness.

The leading symptoms are a slow onset, with pallor of the skin, dyspnea on exertion, increasing weakness, edema of the ankles or eyes, palpitation of the heart, a soft, feeble pulse, hemic murmurs, and finally prostration and stupor develop. The number of red blood corpuscles is increasingly diminished, but there is not a corresponding diminution in the amount of hemoglobin. The size and shape of the red blood corpuscles is very much changed, and macrocytes, poikilocytes, megalocytes, and microcytes are present, together with a diminution in the number of leucocytes.

Adjustment.—A careful spinal analysis should be made, and adjustments made as indicated. Rest in bed is indicated in all cases. Fresh air, nutritious food, salt baths and other hygienic measures should be employed.

Leukemia

Etiology.—The cause of this disease is rather uncertain, but it is due primarily to a grave functional disturbance in the blood-forming organs, the underlying basis of which is a marked derangement of the nervous system.

Pathology.—The disease occurs in two forms, first lymphatic leukemia; second, spleno-medullary, or myelogenous leukemia. In both cases the white corpuscles are greatly increased in number. In the lymphatic form the lymph glands are moderately enlarged. In spleno-medullary leukemia the spleen and liver are increased in size in over half the cases, and the bone marrow is changed.

In the spleno-medullary form of leukemia the red cells are greatly decreased in number, while the white corpuscles are markedly increased, the myelocytes being in excess of all other forms of white corpuscles combined. In the lymphatic form, however, the myelocytes are diminished in number, while the lymphocytes constitute nearly 90 per cent of the total number of leucocytes present.

Symptoms.—In the lymphatic form the glands are enlarged; in the spleno-medullary form the spleen is markedly increased in size. In most varieties the disease commences gradually, and the symptoms are similar to those of pernicious anemia.

Adjustment.—The same as that of pernicious anemia.

Hodgkin's Disease (Pseudo-Leukemia)

Etiology.—No definite cause of this disease is known. It is very likely due to a deep-seated disturbance in the autonomic nervous system.

Pathology.—"A hyperplasia of the lymph glands interfering more or less with their function. The enlargement may be confined to one isolated glan, or a number may be affected in different portions of the body, or a number in one location may be simultaneously affected, causing a tumor varying in size from an egg to an orange, or even larger. The spleen and liver are involved in two-thirds of the cases. The marrow of the long bones may be converted into a rich lymphoid tissue." (Osler.) "The red blood corpuscles are decreased in number, and altered in size and shape; the white blood corpuscles may be slightly increased in number, but there is no approximation to anything like true leukemia." (Hughes.)

Symptoms.—The disease commences very gradually, the first symptom noticed being an enlargement of the lymph glands in the neck, after which all the glands in the body become affected. Anemia then develops, and becomes progressively worse. The symptoms of leukemia then follow. The number of leucocytes is very little increased.

Adjustment.—The same as that of pernicious anemia.

Addison's Disease

Etiology.—This disease occurs most commonly in men from the ages of 30 to 50 years. It is due to some destructive process in the suprarenal glands, which acts by virtue of a disturbance in the integrity of the gland induced by faulty innervation.

Pathology.—The most common destructive process in the gland which occurs when their innervation is withdrawn, is tuberculosis; inflammation, atrophy or malignant disease may also be contributing causes. Sometimes no destructive lesion of the suprarenal capsule is present, but the disease is occasioned by pressure upon the semilunar ganglion.

Symptoms.—The disease commences very slowly, with a feeling of malaise, gastrointestinal disorders, dyspnea, palpitation of the heart, and dizziness. The skin first becomes pale, and finally changes to a bronze color. Similar changes

in the color occur on the mucous membrane of the mouth.

Adjustment.—Adjust the 4th cervical and the 9th dorsal vertebrae.

Goitre

Etiology.—The primary cause of this disease is a subluxation in the cervical region of the spinal column, which, by impinging the nerves that supply the thyroid gland, cause changes in its functional activity, and organic integrity.

Pathology.—The enlargement of the thyroid gland which is present may be either parenchymatous, interstitial, cystic or vascular.

Symptoms.—There is a gradual enlargement of one of the lobes, or both the lobes and isthmus of the thyroid gland. The enlargement is painless. No symptoms are present unless the growth is large enough to cause pressure symptoms, by encroaching upon the trachea, or by pressing upon vessels and nerves.

Adjustment.—Adjust the 6th cervical vertebra.

Exophthalmic Goitre

Etiology.—This disease is due primarily to a perverted function, namely, excessive activity of the thyroid gland, which is induced by an irritable condition of the nerves which supply the thyroid gland, as a result of impingement by subluxated vertebrae in the mid-cervical region. It is seen more commonly in women than in men, and is caused often by anemia and strong mental emotions.

Symptoms.—The characteristic symptoms of this disease are exophthalmos, a fibrillary tremor of the hand, tachycardia, and enlargement of the thyroid gland. The disease commences insidiously, and runs a chronic course, or it may be acute. Widening of the angle between the eyelids is present, and is known as Stellwag's sign. When the eyeball is turned down and the upper lid does not follow it, exophthalmos is indicated, and this is known as Graefe's sign. Among other symptoms present may be mentioned profuse perspiration, pigmentation of the skin, gastro-intestinal disturbances, anemia, glycosuria, albuminuria and mental depression.

Adjustment.—Adjust the 6th cervical vertebra, as indicated by the spinal analysis. These adjustments are made for their direct effect upon the innervation of the thyroid gland itself; in addition thereto, adjust the 2nd dorsal vertebra for its effect upon the heart. General hygienic measures should be enforced.

Myxedema

Etiology.—This disease occurs in two forms. (1) Cretinism, which is a congenital absence of the thyroid gland; (2) Myxedema of adults, which is atrophy of the gland following withdrawal of its nerve supply. The disease develops about middle life and is more common in women than in men. It may follow total extirpation of the thyroid gland, in which case it is known as Operative Myxedema.

Pathology.—The lesion characteristic of myxedema is atrophy of the thyroid gland which is sometimes more evident in one lobe than in the other.

Symptoms.—In the myxedema of adults the disease commences gradually; the countenance is expressionless, the lips are thick, the nostrils are wide and large. The hair is dry; mentality is deficient; temperature is subnormal. In cretinism the syymptoms are noticeable after the child is about six months old, when it becomes apparent that its growth and mentality are stunted. Other characteristic features are the dry skin, large tongue, and the hair is thin. "About the second year the face is large, bloated and waxy appearing; eyelids puffy; nose depressed and flat; teeth decay; abdomen swollen; legs short; muscular weakness; and large pads of fat in the supra-clavicular region. Idiocy is the rule. Those that survive youth, grow up dwarfed with short limbs, and enormous enlargement of the articulation." (Kohberger.)

Adjustment.—Make the same adjustments as for exophthalmic goitre. Warm climate. Consultation is advisable in these cases.

CHAPTER XI

Diseases of the Genito-Urinary System

Congestion of the Kidneys

Etiology.—Passive congestion of the kidneys is produced by heart and lung diseases and by pressure upon the renal veins as in pregnancy, dropsy and abdominal tumors. Active congestion of the kidneys is seen in the first stages of nephritis, or after taking irritating drugs. Both forms of congestion, no matter what the direct causes may be, are superinduced by faulty innervation, as a result of a subluxation producing impingement upon those nerves which supply the kidneys.

Pathology.—The kidneys are enlarged, and in passive congestion they are of a blue color, while in active congestion, their color is red. A catarrhal condition of the tubules is present, together with proliferation of the connective tissue of the parenchyma of the kidney, causing it to become hardened and contracted.

Symptoms.—In passive congestion the alterations of the kidney are overshadowed by the heart and lung symptoms, but later it becomes evident that the kidneys are affected when ascites is present, and the urine becomes very much diminished in amount, contains albumin, and is high colored. In the active form of congestion of the kidneys, there is pain in the lumbar region, which extends towards the front, and follows the course of the ureters into the testes. The bladder is very irritable, the urine scanty, and may contain blood, casts, fibrin and albumin. There is a constant desire to urinate, but usually no pain accompanies the act of urination. Constitutional syymptoms, such as a general feeling of discomfort, nausea and vomiting, and headache are present.

Adjustment.—Adjust the 10th dorsal vertebra, and any others which may be found subluxated. As soon as the diagnosis has been made, the patient should be put in bed, a liquid diet prescribed, and the bowels cleansed by an

enema. The cause should then be ascertained and adjustment directed toward its removal.

Acute Parenchymatous Nephritis (Acute Bright's Disease)

Etiology.—The most common causes of acute Bright's disease are exposure to cold and wet, infectious diseases, and the use of irritant drugs, which are eliminated by the kidneys. It also occurs in connection with some skin diseases, and acute infectious fevers. These conditions all cause more or less irritability of the kidneys, as a result of which a reflex subluxation is produced in the segment which controls the kidneys, namely, the 10th thoracic, in consequence of which the conduction of impulses to the kidneys are interfered with, and functional and organic derangements ensue. It is, however, frequently due to direct injuries of the back, which induce a subluxation of the 10th thoracic vertebra, and which later predispose to Bright's disease.

Pathology.—The kidneys are increased in size, congested, and of a very red color. Later on the tubules become engorged with epithelial cells, blood corpuscles and fibrin. The capsule of the kidney is very loose. If proper treatment is instituted, and the case terminates favorably, the organ returns to its normal size, the congestion disappears, and the tubules regain their normal state.

Symptoms.—The disease usually commences suddenly, with a chill. Dropsy, dyspnea, and prostration then develop. There is usually a moderate rise in temperature. Gastro-intestinal symptoms later develop. Pain may be present in the lumbar region, although this is not a constant feature. There is an almost constant desire to urinate. The pulse is tense, full and rapid, and the skin is harsh and dry. In cases which follow scarlet fever, anemia and prostration are extreme. Symptoms of uremia may develop. The urine is scanty, smoky and of a high specific gravity. Albumin, together with hyaline, granular, epithelial and blood casts are present. Phoshates, chlorides and urea are decreased in amount.

Adjustment.—Adjust the 10th, 11th or 12th thoracic vertebra. The patient should be placed in bed, and remain there until all symptoms have disappeared. The diet is very important, and during the height of the disease

should consist of milk only. The patient should drink large amounts of water. The bowels should be kept open by adjustment of the 2nd lumbar vertebra. Free perspiration should be induced daily by adjustment of the 6th and 10th dorsal vertebrae.

Chronic Parenchymatous Nephritis (Chronic Bright's Disease; Large White Kidney)

Etiology.—The primary cause of this disease is subluxation of the 10th to the 12th thoracic vertebrae, which interferes with the conduction of nerve impulses to the kidneys, and induces organic changes therein. The disease may follow the acute form, in which case it is the result of reflex subluxations, which occur during the course of the acute variety. This form of chronic Bright's disease is seen most commonly in men before the age of 40. Contributing causes are constant exposure to wet and cold, excessive use of alcohol, various forms of intoxication, syphilis, diseases of the liver, and tuberculosis.

Pathology.—The kidney is increased to twice its normal size, and of a white or yellowish color. The tubules are thickened and dilated, and engorged with epithelial cells, debris and casts. The medullary portion of the kidney is thickened as a result of the increase in the amount of connective tissue, and as the disease progresses, this connective tissue has a tendency to become contracted, and finally the kidney becomes reduced in size, and its surface is irregular.

Symptoms.—The disease commences very gradually, and its onset is characterized my malaise, anemia, gastro- intestinal disorders, edema of the eyelids, especially in the morning, difficult breathing and palpitation of the heart. Later symptoms are severe headache, dizziness, failing vision, nausea and vomiting, and general dropsy. Enlargement of the heart and high blood pressure are common symptoms. Symptoms of uremia may develop at any time during the course of the disease. Irritability of the bladder is an early and constant symptom. The enormous loss of albumin, together with the gastro-intestinal disturbances, result in a marked anemia. The urine is scanty, highly colored, and contains albumin and granular, hyaline and fatty casts. Later the amount of urine may become increased. All the

normal constituents of the urine are diminished in amount, and one point of particular importance is the fact that the greater the diminution of the amount of chlorides becomes, the greater is the amount of albumin present, and the more unfavorable the prognosis becomes. Dangerous complications arise during the course of the disease, chief among which are uremia, pneumonia, enlargement of the heart, apoplexy, and edema of the lungs.

Adjustment.—Adjust the 10th, 11th or 12th dorsal vertebra. The next most important measure in this disease is attention to the diet, since an unsuitable diet may produce a great deal of harm. The diet must be so selected as to keep up the body weight, or even to increase it. At the same time it must make as little demands upon the renal activity as possible, and be free from any substance which could possibly cause an irritation of the kidneys. The patient must be guarded against taking cold, since this may bring on an acute attack. He should keep his feet well protected, and wear woolen underwear, with the addition of a flannel band about the loins. Residence in a warm climate is preferable. Moderate exercise in the open air is advisable, but should not be excessive. Overwork, mental worry, anxiety, etc., should be avoided. The bowels should be kept open at all times.

Chronic Interstitial Nephritis (Chronic Bright's Disease; Small Red Kidney)

Etiology.—The primary cause of this affection is imperfect innervation of the kidney. That withdrawal of innervation may produce interstitial nephritis is proved by the fact that changes in the renal ganglionic centers may also cause this disease. It is seen most commonly in men between the ages of 40 and 60 years. It may also occur secondarily to chronic parenchymatous nephritis. Among the conditions which predispose to the contraction of this disease are alcoholism, syphilis, mental worry, grief or anxiety, chronic lead poisoning, gout, chronic gonorrhea, cystitis, liver diseases, and passive congestion as a result of heart disease.

Pathology.—There is first of all an inflammation of the intervening connective tissue of the kidney, which is of a

chronic form, and results in hardening and contraction of the organ. The kidneys are very much diminished in size; their surface is granular and covered by numerous small cysts, and the capsule is very adherent. The cortex of the kidney is atrophied. The interstitial tissue of the kidney is converted into fibrous tissue. The arteries are very much sclerosed. The glomeruli are degenerated and atrophied; the tubules are degenerated and converted into thread-like capillaries.

Symptoms.—The disease commences so insidiously that often it is not recognized until serious symptoms appear. For some time previously the heart and vessels have been affected. The characteristic symptoms of the disease are frequent micturition of large amounts of a pale, highly acid urine, of low specific gravity, and containing a very small amount of albumin, which may, however, not be evident for weeks at a time. Sometimes epithelial cells and granular and hyaline casts are present. Progressive anemia is a common symptom of the disorder, and there is great weakness and loss of flesh and strength. Dyspnea is a common symptom. There is no dropsy, but a little edema of the eyelids. Vision is impaired. Albuminuric retinitis is present. High blood pressure is a constant feature, and heart action is very forcible, owing to the hypertrophy of the heart, which is generally present. Other symptoms are headache, dizziness and palpitation of the heart. Uremia may develop at any time during the course of the disease, and is shown by excessive digestive disturbances, headache, dizziness, drowsiness, convulsions, or apoplectic attacks.

Adjustment.—Adjust the 10th to the 12th dorsal vertebrae. In general the management of the case is the same as that of the chronic parenchymatous form of Bright's Disease.

Uremia

Etiology.—This is a group of symptoms rather than a specific disease, and the cause is the absorption by the blood of excrementitious matter which should be excreted in the urine. The resulting intoxication is manifested by a group of extreme nervous phenomena. It is seen during the course of acute or chronic Bright's disease.

Symptoms.—Uremia exists in two forms, the acute and chronic. In the acute form of uremia the onset may be slow or sudden. The common symptoms present are headache, which is usually in the occipital region, and extends down the back of the neck, nausea and vomiting, dyspnea, vertigo, insomnia, or stupor, and convulsions. The convulsions may become more and more severe, and the patient finally passes into a comatose condition. The common symptoms of chronic uremia are similar to those of acute uremia, but less severe. There is constant headache and dyspnea, nausea and vomiting, insomnia, cramps in the calves, and itching of the skin. Convulsions or twitchings of the muscles occur at times. The urine is diminished in amount, contains large amounts of albumin, and a diminished amount of urea. The blood contains a large amount of urea.

Adjustment.—The chronic form of uremia is managed in the same manner as chronic Bright's disease. In acute uremia adjust the 1st and 2nd cervical, and the 6th and 10th dorsal vertebrae.

Amyloid Kidney (Waxy Kidney)

Etiology.—Waxy degeneration of the kidneys is seen in chronic suppuration, lead poisoning, gout, and leukemia. It often follows chronic parenchymatous nephritis. It is seen in connection with waxy degeneration of the spleen and liver.

Pathology.—The kidneys are enlarged and hard, and have a peculiar waxy appearance, which, on being treated with a solution of iodine, change to a deep mahogany red color. Lesions showing chronic nephritis are also present.

Symptoms.—The previous personal history of the patient must be taken into consideration, and it must be determined whether or not there is an associated enlargement of the liver and spleen. Dropsy and diarrhea, together with uremic symptoms, and high blood pressure, are present in connection with a profound cachexia. The urine is increased in amount, of a low specific gravity, and a pale color. Albumin is present, together with hyaline, granular and fatty casts.

Adjustment.—This is the same as that of chronic inter-

stitial nephritis. In addition to this the underlying cause must in all cases be attended to.

Movable Kidney (Floating Kidney)

Etiology.—The primary cause of this condition is an interference with the nerve supply of the supports of the kidney, as a result of which the tissues about the kidney become so lax and atrophic that the kidney is permitted to leave its normal location, and float about in the abdomen. This condition is seen most commonly in women, and important contributing causes are relaxation of the abdominal wall, wearing of tight corsets, trauma, increased weight of the kidneys, rapid emaciation, and pressure upon the kidneys by tumors adjacent to it.

Symptoms.—In some cases the patient is unaware of the condition, and should then not be told of it, for the tendency to neurasthenia in those who are aware of their condition is very great. The most important symptoms are a heavy pain in the abdomen, increased by standing or walking. Various reflex disturbances such as neuralgic pains, irritability of the bladder and palpitation may be present. At times the ureters and renal vessels may become twisted, and paroxysms of agonizing pain, known as Dietl's crises occur.

Adjustment.—Adjust the 6th and 10th dorsal vertebrae, and any other subluxations which may be found after a careful spinal analysis has been made. In addition to this the general health should be improved by the use of a suitable diet, well directed exercises, and hygienic measures. Sometimes the condition is relieved by lying on the back for an hour or two each day, while in other cases relief is obtained by wearing a suitable support or binder, to keep the kidney in its proper position. When the paroxysms due to the twisting of the ureters occur, the patient should be placed in bed, and hot applications over the lumbar region are indicated. Uusually, however, the adjustments alone will suffice to produce a cure, by restoring the normal tonicity to the supports of the kidney, through restoration of their nerve supply.

Hydronephrosis

Etiology.—This is a cystic condition of the kidney, which is due to an obstruction of the ureter, by twisting, calculus, or tumors. As a result of the obstruction of the ureter, the urinary secretion is retained in the kidneys.

Pathology.—The pelvis of the kidney is first dilated by the accumulating fluid and as its amount increases, pressure of the fluid upon the parenchyma produces gradual atrophy of the kidney structure, until the whole kidney is converted into a sac containing fluid.

Symptoms.—As soon as the amount of fluid becomes large, a soft, fluctuating tumor appears in the lumbar region. This tumor is the cystic kidney, and contains a serous fluid, containing uric acid and urea. The tumor is painless on palpation, and dullness is elicited upon percussion over it.

Adjustment.—Adjust the 6th and 10th dorsal vertebrae. In chronic cases the treatment is usually surgical.

Nephrolithiasis (Renal Calculi, Kidney Stone, Gravel)

Etiology.—The primary cause of this disease is a disturbance of the innervation to the kidneys as a result of which the urinary secretion is changed, and the salts of the urine are permitted to deposit, and form either gravel, which is like fine sand, or to deposit around a previously existing nucleus, to form a stone. The nucleus may be a dried particle of mucus or blood, or consist of the same material as the surrounding stone. The disease occurs most commonly in men between the ages of 40 and 50 years.

Symptoms.—No signs of this condition may be present until a stone becomes lodged in one of the ureters, when an attack of renal colic takes place. This is shown chiefly by severe pain in the lumbar region, which radiates along the ureters to the testicles. Each attack of colic is accompanied by nausea and vomiting, subnormal temperature, faintness, pallor of the face, and irritability of the bladder. Upon the stone passing into the bladder, the symptoms disappear. The amount of urine is diminished, on account of the obstruction of the ureter, and the urine which is voided, contains small amounts of blood. Should the condition be present on both sides, namely both ureters obstructed, uremia will develop. Between the attacks of renal colic there is

always a certain amount of pain and soreness over the kidneys, and the urine is stained with blood. In addition to the presence of blood the urine also contains albumin and hyaline casts, and its specific gravity is high.

Adjustment.—Adjust the 10th, 11th or 12th thoracic vertebra. During the attack of renal colic, the patient should be placed in a hot both. Hot compresses should be applied to the lumbar region, and large amounts of hot water should be drunk. During the interval between attacks the patient should drink freely of alkaline mineral water. Meat should be very sparingly used or not at all, and the diet should consist principally of milk and vegetables. If the stone is large or if numerous stones are present, and impair the kidney or ureters so as to threaten life, surgical measures are indicated.

Pyelitis (Pyelo-Nephritis; Suppurative Nephritis)

Etiology.—The primary cause of this disease is a lack of resistance of the kidney structure to the invasion of bacteria, caused by faulty innervation of the organ. A catarrhal condition of the pelvis of the kidney usually precedes the invasion of pus. Predisposing causes are exposure to cold and wet, inflammation of the bladder, long use of irritating drugs, rheumatism, infectious diseases, and kidney stones.

Pathology.—There is a catarrhal or suppurative inflammation of the pelvis of the kidney and ureters. Pus is formed constantly, and escapes with the urine, when there is no obstruction of the ureters; if, however, this outflow is prevented, it accumulates in the kidneys, and gives rise to the disease known as Pyelonephrosis. Pressure of the accumulated pus causes an atrophy of the kidney structure. This is followed by the formation of pus which is constantly accumulating, and if no obstruction of the ureter is present, it escapes with the urine. If, however, its outflow is impeded, it accumulates in the pelvis of the kidney, and the pressure which it produces upon the parenchyma of the kidney causes the latter to atrophy, and the kidney finally becomes converted into a sac filled with pus, in other words, an abscess. The kidney is now in the same condition as in hydronephrosis, except that the fluid, instead of being water, is pus.

Symptoms.—The characteristic symptoms of this condition are pain and tenderness on deep pressure over the kidneys. The symptoms common to septic infection in any part of the body, namely, alternate fever and chills, occur. The urine is cloudy and of an acid reaction, and contains mucus, pus and red blood corpuscles. If the affection becomes chronic, anemia, progressive loss of flesh and strength, and finally cachexia develop.

Adjustment.—In mild cases adjustment of the 10th, 11th or 12th thoracic vertebrae may be sufficient to overcome the condition. In addition to this the patient should remain in bed, and drink large amounts of alkaline mineral water, and the diet should be light and nutritious, and non-irritating. Hot compresses over the kidneys are very beneficial. In chronic cases, when an abscess has developed, surgical measures are necessary.

Cystitis (Catarrh of the Bladder)

Etiology.—Catarrh of the bladder is seen in two forms, the acute and the chronic. In both cases the primary cause of the affection is an interference with the innervation of the organ. This lack of innervation renders the bladder susceptible to the invasion of the contributing causes, chief of which are the infectious fevers, presence of foreign bodies in the bladder, the extension of a suppurative inflammation to the bladder from the kidneys or from the urethra, traumatism, and the retention of urine in the bladder for long periods of time. The chronic form may be engrafted upon the acute variety, or the integrity of its mucous lining may be impaired, by withdrawal of its innervation, when the addition of such causes as calculi, retention of urine, large prostate or urethral stricture, gout, and chronic Bright's disease are present.

Pathology.—Acute cystitis commences with congestion of the mucous membrane during the course of which small blood vessels may rupture and cause minute hemorrhages. If the inflammation is extreme, it may end in ulceration.

In chronic cystitis the bladder wall is thickened, its mucous lining is gray and covered with large amounts of muco-purulent material.

Symptoms.—Acute cystitis commences very suddenly

with a chill, slight fever, a feeling of malaise, insomnia and loss of appetite. There is frequent urination, which is accompanied by intense pain. Pain over the bladder, in the inguinal region, and along the course of the urethra, is present. The urine is cloudy, of an alkaline reaction, and contains red blood cells, pus, and epithelium.

Chronic cystitis commences slowly, and is characterized by a dull pain over the bladder and frequent voiding of small amounts of urine. The urine is alkaline in reaction, and contains large quantities of pus. If an ulcerative process is present, intense pain over the bladder, presence of blood in the urine, and loss of flesh and strength will be noted. In all cases the symptoms of the contributing cause are present.

Adjustment.—Adjust the 11th dorsal and the 5th lumbar vertebrae. Adjust also for the relief of the causative factors. In addition, the patient should, in all acute cases, be confined in bed and placed on a milk diet. Large amounts of water should be drunk to dilute the urine as much as possible. All highly seasoned and irritating foods should be avoided.

Hypertrophy of the Prostate

Etiology.—The primary cause of enlargement of the prostate gland is interference with the conduction of normal nerve impulses to the organ. It is seen most commonly in men about the age of 60, and among the important contributing causes may be mentioned sendentary occupation, cystitis, sluggish circulation, a foreign body in the bladder, stricture of the urethra, numerous previous attacks of gonorrhea, excessive use of diuretic drugs, and alcoholic liquors, exposure to cold, gout, and rheumatism, traumatism, and habitual straining at stool.

Pathology.—The prostate gland is enlarged, hard and indurated. The enlargement is uniform, and the isthmus and two lateral lobes of the gland can be distinctly felt as three separate tumors.

Symptoms.—These are not apparent until the hypertrophy has existed for some time. The enlargement is not painful of itself, and pain is not present until there is mechanical interference with the function of urination. Incon-

tinence of urine at night is a common symptom. A muco-purulent urethral discharge is present. The patient is very irritable; there are alternating chills and fevers, digestive disturbances, loss of flesh and strength.

Adjustment.—Adjust the 12th dorsal or 1st lumbar and the 4th lumbar vertebrae.

Enuresis (Bed-Wetting)

Etiology.—The primary cause of this condition is a derangement of the functional activity of the bladder, due to faulty innervation or an irritable condition of the micturition centers. It may also be produced reflexly from some irritation of the genito-urinary system, and is seen most commonly in persons of a nervous temperament, who are suffering from anemia and faulty nutrition. It also occurs in diseases of the central nervous system.

Symptoms.—The characteristic symptom is unconscious voiding of urine. This occurs especially at night, and may take place every night, or only at intervals.

Adjustment.—Adjust the 11th dorsal and the 4th lumbar vertebrae. The bowels should be regulated. The evening meal should be light and no liquids should be taken after 5 o'clock. Look for lesions in the genito-urinary system, which may reflexly induce the condition, such as phimosis.

CHAPTER XII

Diseases of the Eye and Ear

The reader will note that not all diseases of the eye and ear are given. This is so for the reason that so many of these diseases are obviously in the realm of the specialist in eye and ear diseases and only those which we know respond to treatment by vertebral adjustments are therefore given.

Lachrymation

This condition is a symptom rather than a disease, and is characterized, as its name implies, by an excessive flow of tears, occasioned by irritation of the eye and its appendages, as a result of which the secretion of the lachrymal glands is increased. This is produced by an overstimulation of the afferent nerves, which reflexly excite the efferent nerves to over-activity, with the resulting increase in the functional activity of the lachrymal gland. Adjustment of the 4th cervical and 5th dorsal vertebrae is productive of good results in most cases.

Amblyopia

By this term is meant a defect in vision which is not due to a lesion of the eyeball or error of refraction. When the defective vision is due to causes other than those mentioned, it may be corrected by adjustment of the 4th cervical and the 5th dorsal vertebrae, together with removal of the cause which may be present.

Strabismus (Squint)

This is a condition in which the lines of sight do not meet at the objective point. The vision of the affected eye is very often defective. Selected cases of strabismus or squint, may be corrected by adjustment of the 4th cervical, and the 5th dorsal vertebrae. When the condition is due to disuse, as is true in some cases, the better eye should be covered, and the affected eye used exclusively for a time.

Cataract

A cataract is an opacity of the lens of the eye, or its envelope. In some cases surgical measures are the only means of relief. In other cases, however, adjustment of the 4th cervical and the 5th dorsal vertebrae have been productive of good results in these cases.

Stye

This is a circumscribed, acute inflammation of the tissues about the glands of the margin of the eyelid, which frequently terminates in suppuration. Styes very often occur in crops, and are seen in young adults, being produced most commonly by gastro-intestinal disorders. Adjust the 4th cervical and the 5th dorsal vertebrae. Attention should be given to the gastro-intestinal system.

Ptosis

This is a drooping of the upper eyelids, due to paralysis, or faulty development of the levator palpebrae muscle. It may exist in any degree, and be sufficient to entirely cover the eye. It may be congenital, in which case it is bilateral, and is due to faulty development of the levator palpebrae muscle, and accompanies other congenital defects. The acquired form is generally unilateral, and is caused by paralysis of a branch of the 3rd nerve that innervates the levator palpebrae. Adjustment of the 4th cervical and the 5th dorsal vertebrae is effective in many cases.

Mydriasis and Myosis

Mydriasis is the term used to designate dilatation of the pupil, while myosis designates contraction of the pupils. Mydriasis may be due to paralysis of the nerves which produce contraction of the pupil, namely, the third cranial nerve, or to stimulation of the autonomic fibers, which normally dilate the pupil. In myosis the opposite is true, namely, there is stimulation of the 3rd cranial nerve, and paralysis of the autonomic nerve fibers. This condition very often responds readily to adjustments of the 3rd to 5th cervical and the 5th dorsal vertebrae.

Retinitis

There are various forms of inflammation of the retina, namely, simple retinitis, albuminuric retinitis, syphilitic

retinitis, diabetic retinitis, and hemorrhagic retinitis. Some cases are amenable to adjustment, while others are not, and a guarded prognosis is therefore to be given in every case. Adjust the 4th cervical and the 5th thoracic vertebrae. The eye should be protected from the light, and should not be used. The contributing causes should be corrected.

Optic Neuritis

Inflammation of the optic nerve often results from extension of an inflammation in the brain, or may be produced by tumors of the brain. It also frequently accompanies anemia, arteriosclerosis, rheumatism, Bright's disease, syphilis, and infectious diseases. Adjust the 4th cervical and the 5th dorsal vertebrae. Attention should also be given to the underlying cause of the condition.

Ear-ache

Ear-ache is a symptom of nearly all abnormal conditions of the auditory apparatus, and while some of these diseases are not always amenable to adjustment, the pain in the ear is greatly reduced by correction of subluxations in the upper cervical and upper thoracic region. Adjust the 4th cervical and the 5th dorsal vertebrae.

Tinnitus Aurium

A ringing, roaring or hissing sound in the ear proceeds from many causes. One of the most common is a general neurasthenic condition. Congestion, sunstroke, alcoholism, and arteriosclerosis, are also responsible for this disorder. Should the noises be synchronous with the beat of the heart and of a pulsating character, and further, should they be suspended by pressing on the carotid arteries, they are in all probability due to aneurysm, inflammatory congestion, or paralysis of the vaso-motor nerves. Continual rushing, pulsating, knocking noises are likely caused by inflammatory conditions in the labyrinth. Bubbling, gurgling, singing or shell-like roaring indicates fluid exudations or catarrh of the Eustachian tube. A dry, roaring and ringing sound is due to catarrah of the middle ear, or insufficient nerve-supply to the tympanum. Many such cases are relieved by adjustment of the upper cervical vertebrae, and the 5th

dorsal vertebrae. In all cases the underlying cause as mentioned should be corrected.

Deafness

Deafness may be due either to a disease of the auditory apparatus, or to a lesion affecting the integrity of the auditory nerve. To distinguish between them, a vibrating tuning fork should be placed upon the head, and if the vibrations are heard, it is an indication that the lesion producing the deafness is located in the auditory apparatus; if the vibrations are not heard, it is evidence that the lesion is of the auditory nerve. Deafness is produced by a great variety of causes, and each individual case should be carefully studied, with a view to determining the exact nature and location of the contributing cause. In many of these cases adjustment of the upper cervical and upper dorsal vertebrae, supplemented by measures directed to the relief of the causative factors, are productive of good results.

Otitis Externa

Inflammation of the external auditory meatus may be either acute or chronic, and affect the greater part of, if not the entire lining of, the external ear. It is due primarily to faulty innervation of the parts, as a result of which its resistance is rendered feeble, and it becomes susceptible to the invasion of various forms of bacteria. The condition commences with an itching sensation in the external auditory meatus; severe radiating pain then follows, which is aggravated by lying upon the affected side, or by movements of the jaws. Ringing of the ears and deafness may occur. Adjustment of the upper cervical and upper dorsal veretebrae promptly relieves the condition in most cases.

Otitis Media

Inflammation of the middle ear may occur either acutely or chronically. In either case, but more especially in the chronic form, the disorder is due to faulty innervation of the middle ear. Contributing causes of the acute variety are the extension of an inflammatory process from the nose, sudden changes in temperature, and constitutional debility. The primary cause of the chronic form is faulty innervation

which is due to reflex subluxations which were produced during the course of the acute form. Contributing causes are excessive use of alcohol and tobacco, and a prolongation of the contributing causes of the acute form. The condition is commonly manifested by partial deafness, ringing of the ears, and pain. These symptoms increase in severity, and frequently pus forms in the middle ear, and systemic disturbances then become marked. The treatment of many of these affections should be left to the specialist, but many of these cases, if taken early, are relieved by adjustment of the upper cervical and upper dorsal vertebrae. Causative factors should, in all cases, be corrected.

Vertigo

Dizziness may be due to a great variety of causes, but is essentially produced by a disturbance of the cochlear part of the auditory nerve. Auditory vertigo is due to disease of the labyrinth, and is frequently accompanied by nausea and sometimes syncope; this form of vertigo is known also as Menier's disease, and is accompanied by deafness and tinnitus. A history of syphilis, gout or injury may also be present. Vertigo may also be produced reflexly from stomach or liver disorders. Anything which interferes with the continuous flow of nerve-impulses from the eye, the joints, the viscera, or the ear, will interfere with the relation of the body to external objects, and will produce vertigo. No matter what the varying symptoms may be, the cause is in all cases the same, namely, an interference with the nicely balanced co-relation of the different parts of the body, the function of which is to maintain the consciousness of equilibrium. When the nerve impulses are in any way interfered with, the result is disharmony. Such a disturbance of normal vibrations can also be produced by mechanical causes, as the movements of cars, ships, or whirling rapidly around. In such cases the symptoms will disappear immediately upon removal of the promoting cause, since in such cases the vibrations are at once restored. In the adjustment of this affection, the correction of the cause is the first consideration. In all cases adjustment of the upper cervical, lower dorsal and upper lumbar vertebrae should be made.

Impacted Cerumen

By this term is meant the collection in the external auditory meatus, of an increased amount of ear-wax, mixed with debris, and rendered dry and hard. The essential symptoms are similar to obstruction of the auditory meatus, by any foreign body. So long as the plug of wax does not impinge against the drum membrane, no symptoms may be present. If the collection of wax is sufficient to occlude the meatus, tinnitus, partial deafness, pain, and a sense of fullness in the meatus, are the leading symptoms. A condition of malaise, reflex cough, and nausea and vomiting sometimes occur. Adjustment consists in removal of the collection of wax by syringing the ear with a warm solution of sodium bicarbonate. Adjust the upper cervical and the 5th dorsal vertebrae.

Inflammation of the Eustachian Tube

The primary cause of this affection is a low grade of resistance of the Eustachian tube, induced by faulty innervation. The most common contributing causes are extension of an inflammation from the nose or throat; various other abnormalities of the naso-pharynx; and a general debilitated condition. Attention should first of all be directed toward the removal of the exciting cause. Following this, or in connection therewith, adjust the upper cervical and the upper dorsal vertebrae.

CHAPTER XIII

Gynecological Diseases

Some gynecological affections are so manifestly in the realm of the specialist in Diseases of Women, that they will not be referred to here. Only such as are amenable to vertebral adjustment will be discussed.

Vulvitis

Etiology.—Simple vulvitis is contributed to by lack of cleanliness, irritation, and the presence of foreign bodies, all of which reflexly excite the production of subluxations in the upper lumbar region, as a result of which the inflammatory process may become chronic.

Symptoms.—The affected parts are red, swollen, congested, and painful. The mucous membrane covering the part is dry, and later becomes covered with a mucous secretion, and desquamation of large areas of the mucous membrane may occur.

Adjustment.—The prime consideration is cleanliness, and the parts should be washed several times a day with normal salt solution. Adjust the 1st, 2nd or 3rd lumbar vertebra.

Pruritis Vulvae

Etiology.—This condition is due to anything which produces a congestion of the parts, such as pregnancy and tumors. It is also due to uncleanliness, and to the irritating effects of discharges from the upper part of the genital tract.

Vaginitis

Etiology.—The predisposing cause of inflammation of the vagina is a general impairment of the health, due to faulty innervation. Other predisposing causes are any conditions which produce congestion of the pelvis, as tumors and pregnancy. The exciting causes are various forms of local irritation, such as discharges from the uterus, and mechanical irritation.

Symptoms.—Characteristic symptoms of this condition are burning pain and itching about the opening of the vagina, and heavy sensations in the vagina itself, accompanied by frequent desire to micturate. There is a large amount of a greenish or yellowish discharge, containing a small amount of blood, and consisting of mucus or muco-pus. There is also a dragging pain in the back and pelvis. In chronic cases the symptoms are very similar, though not so marked. In every case a microscopical examination should be made of the discharge, to determine the presence of gonorrhea.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. The patient should refrain from moving about for several days. The diet should be liquid, chiefly.

Dysmenorrhea

Etiology.—There are several forms of dysmenorrhea, the most common of which are membranous, mechanical, congestive, neuralgic, and ovarian.

Membranous dysmenorrhea is painful menstruation due to the expulsion of membranes and clots from the uterus. Mechanical dysmenorrhea is painful menstruation due to obstructions in the cervix, the os uteri, or the vagina. Congestive dysmenorrhea is caused by any condition which causes an inflammation of the pelvic organs or cellular tissue. Neuralgic dysmenorrhea is seen most commonly in women of a nervous temperament. Ovarian dysmenorrhea is due to co-incident ovarian disease.

Symptoms.—In membranous dysmenorrhea the pain commences a short time before the onset of menstruation, and increases until the membrane is expelled. These pains are cramp-like in character, are due to contractions of the uterus, and the os is dilated. A profuse flow often accompanies this form of dysmenorrhea.

In mechanical dysmenorrhea the pains are still more cramp-like, often approaching those experienced in miscarriage. The obstruction to the free outflow of blood causes an accumulation thereof in the uterus and its presence induces the contractions of the womb. This is the form of dysmenorrhea which is seen so commonly in young women suffering from anteflexion of the uterus. Following

one pregnancy this form of dysmenorrhea usually ceases, since the anteflexion is corrected by the tendency to retroversion, which always follows pregnancy.

Congestive dysmenorrhea is accompanied by intense pain in the pelvis throughout the menstrual period, with a slight diminution in its severity when relieved by a temporarily free flow. Systemic disturbances are present, and may sometimes be extreme.

Neuralgic dysmenorrhea is characterized by pain which is marked just before and for the first few hours during the menstrual flow. The pain is situated in the pelvis and extends around to the lumbar region. It is a steady, sharp pain, and not cramp-like, as that in the other forms of dysmenorrhea. There are no signs of inflammation, and the flow is steady, and contains no clots.

In ovarian dysmenorrhea the pain is always present before the onset of the flow, although it may commence several days before it. The pain is experienced in the pelvis, and is referred down the thigh, and the mammary glands may become sensitive. There is often extreme nervousness and sometimes hysteria.

Adjustment.—In all cases adjust the 1st, 2nd or 3rd lumbar vertebra. In congestive dysmenorrhea, adjust the 7th cervical vertebra. The cause should be ascertained in every case, and appropriate adjustments be made.

Menorrhagia and Metrorrhagia

Etiology.—Menorrhagia is an abnormally profuse menstrual discharge. Metrorrhagia is a flow of blood from the uterus at times other than the menstrual period. These conditions are, in reality, symptoms rather than diseases, per se. The most common causes not in direct relation with the uterus itself, are hemophilia, extra-uterine pregnancy, diseases of the ovaries and tubes, and diseases of the heart, liver and kidneys. Uterine disorders which may cause these symptoms are subinvolution, malignant disease, endometritis, and perimetritis, incomplete abortion, and polypi.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. In all cases the cause should be ascertained, and proper adjustment instituted. Sometimes it becomes necessary to pack the vagina if the hemorrhage is profuse.

Amenorrhea

Etiology.—Absence of the menstrual flow may be normally caused by pregnancy; it is also normally present in lactation and during the menopause. Abnormal amenorrhea is caused chiefly by exposure to cold and wet, mental or physical shocks, sorrow, etc., accompanying various diseases, stenosis of the cervix, obesity, infantile uterus, a vicarious flow, and anything which makes great demands upon the nervous system.

Symptoms.—The symptoms present are usually referable to the primary cause of the condition.

Adjustment.—Adjust the 10th dorsal and 3rd lumbar vertebrae. In all cases adjustment should be directed toward the relief of the primary cause of the condition.

Etiology.—A whitish mucous, or muco-purulent dis-

Leucorrhea

charge is seen in prolapse of the uterus, retrodisplacement, carcinoma of the uterus, and anteflexion.

Adjustment.—Leucorrhea being a symptom rather than a disease, per se, the primary cause thereof should be corrected. In all cases adjust the 10th dorsal and 3rd lumbar vertebrae.

Anteflexion

Etiology.—A bending forward of the body of the uterus upon the cervix is seen most commonly in those who have not borne children. The tendency of pregnancy is to result in retroversion, which tendency invariably corrects a previous anteflexion. The uterus being normally in a slightly anteflexed condition, accentuation of this position is more readily brought about than is retroversion. Among the causes which directly operate to produce the forward position of the uterus may be mentioned inflammation and consequent shortening of the sacro-uterine ligaments, which draw the cervix upward and backward, and thus throw the fundus forward; anything which causes an increase in the weight of the uterus, will, according to its location, induce malposition of the womb, and thus this condition may also induce anteflexion; adhesions between the uterus and the abdominal wall, as a result of perimetritis or peritonitis,

may also draw the body of the uterus forward, and flex it upon the cervix. The operation of any of these factors is facilitated by reduced innervation of the organ.

Symptoms.—The characteristic symptoms of this condition are sterility, dysmenorrhea, menorrhagia, leucorrhea, and symptoms referable to the exciting cause of the condition.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. When adhesions are present, binding the uterus in its abnormal position, manipulations are necessary to replace it in its proper position. This is accomplished by raising the fundus with two or three fingers placed in the vagina, and at the same time drawing the cervix forward. This method either finally breaks the adhesions, or stretches them; the use of tampons placed behind the cervix will serve to hold it in place. If the anteflexion is due to inflammation of the uterus, hot saline douches should be given twice daily. In all cases the bowels should be carefully regulated. In every case the cause should be ascertained, and adjustment directed toward its removal. It goes without saying that surgical measures are sometimes indicated.

Anteversion

Etiology.—In this condition the uterus is directed forward, and the normal bend is obliterated. As a result of this the cervix is higher than normal, and directed backward toward the posterior wall of the vagina, or toward the hollow of the sacrum. Probably the most common predisposing cause of this condition is a relaxation of the uterine ligaments, accompanied by general muscular relaxation throughout the body due to deficient innervation. The most common contributing or exciting causes are subinvolution of the uterus following abortion; any increase in the weight of the uterus, as congestion, hypertrophy, or tumors; weakness of the other supports of the uterus, as laceration of the perineum and prolapse of the vagina; ill-fitting corsets.

Symptoms.—The characteristic symptoms of this condition are sterility, dysmenorrhea, cystitis, frequent urination, rectal tenesmus, and the symptoms of the exciting cause of the condition.

Adjustment.—The adjustment of anteversion is the same as that of anteflexion.

Retroflexion

Etiology.—The primary and predisposing cause of this condition is a weakness of the uterine ligaments due to an interference with their normal nerve-impulses, which maintain them in a state of constant contraction. The most common contributing and exciting causes are anything which increases the weight of the uterus, as pregnancy, hypertrophy, tumors, and subinvolution; adhesions between the uterus and sacrum, or those resulting from pelvic peritonitis; mechanical measures, such as falls, blows, pressure of tumors from the anterior aspect, and a long period of time spent in the dorsal position, following confinement; laceration of the perineum.

Symptoms.—There is a continuous, dull, heavy pain in the lower part of the back, and radiating down the thighs. Headache is a constant symptom of this condition, the pain being situated most commonly at the vertex or in the occipital region. Symptoms referable to the uterus itself are sterility, or repeated abortions, dysmenorrhea, menorrhagia and leucorrhea. Constipation is an almost constant symptom, ribbon-like stools being a characteristic of this condition, and tenesmus occurring after defecation. Cystitis may be present and partial incontinence of urine is a common symptom. After a time many nervous symptoms develop, such as hysteria, melancholia, neurasthenia and other functional neuroses.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. A measure which often meets with success is the assuming by the patient of the knee-chest position for 30 minutes every morning and evening. When adhesions are present, replacement of the uterus in its normal position may be necessary by means of manipulation. Following the manipulations, the introduction of a tampon to maintain the uterus in its normal position, is advisable.

Prolapse of the Uterus

Etiology.—This is a downward displacement of the uterus, which is primarily due to the relaxation of its liga-

ments consequent on improper innervation thereof, in addition to which chronic constipation, general weakness, overwork and a large number of poorly-conducted labors are also common predisposing causes. The most common exciting or direct causes are anything which increases the weight of the uterus, such as pregnancy, hypertrophy and tumors; loss of the supports of the uterus, such as laceration of the perineum, weakness of the abdominal muscles, an extremely large pelvis, and poor tonicity of the vaginal walls; downward displacement of the uterus by pressure from above, as tight-lacing, tumors in the abdomen, dropsy, coughing, or straining at stool; conditions which produce a pulling downward of the uterus from below, as prolapse of the bladder, rectum or vagina.

Symptoms.—The characteristic symptoms of this condition are a dragging, bearing-down weight in the pelvis, pain in the lower part of the back and radiating down the thighs, vertical or occipital headaches, constipation, irritability of the bladder, tenesmus, and various nervous symptoms, such as hysteria, and neurasthenia. Various degrees of prolapse of the uterus may occur; first, the cervix may rest on the pelvic floor; second, it may protrude at the vaginal orifice; third, the entire uterus may escape through the vaginal orifice. Accompanying this condition there may be a protrusion or prolapse of the posterior wall of the vagina, namely, rectocele, or of the anterior wall of the vagina, namely, cystocele.

Adjustment.—The first indication is to replace the uterus, which should be done by having the patient assume the knee-chest position. In cases which have not existed for too long a period, several weeks' rest in bed, with the vagina packed with cotton daily, together with adjustment of the 1st, 2nd or 3rd lumbar vertebra. In advanced cases surgical measures are sometimes necessary.

Acute Endometritis

Etiology.—Inflammation of the mucous lining of the uterus may affect the entire organ or any part of it, and is primarily due to an interference with the proper innervation of the organ. The most common contributing causes are exposure to cold and wet just before or during menstruation,

dysmenorrhea, septic infection, and extension upward of an inflammation in the vagina, and chronic exhausting diseases, especially tuberculosis and Bright's disease, and accompanying long, continued fevers.

Symptoms.—The first symptom of this disease is a heavy sensation and pain in the pelvis, together with pain in the back, loins, and thighs. There is mild fever. The bladder and rectum are both irritable and frequent micturition and diarrhea are present. The discharge appears early in the condition and is at first thin and watery, which indicates that the entire uterus is affected, but later, as the inflammation subsides in the fundus, and becomes limited more particularly to the cervix, the discharge becomes thick and albuminous. In many cases various disorders of menstruation develop. If the cause is a gonococcus infection, all the above symptoms are intensified, and the discharge is of a yellowish-green color.

Adjustment.—The first indication is absolute rest in bed. Adjustment of the 1st, 2nd or 3rd lumbar vertebra. A liquid diet shhould be prescribed. Septic endometritis requires medicinal treatment.

Chronic Endometritis

Etiology.—Various forms of this condition are found, the primary cause of which is, in all cases, faulty innervation of the uterus, as a result of which its tonicity is impaired. In such cases it is simply a continuation of the acute form, or results from an untreated chronic vaginitis. Other direct causes of chronic endometritis are improperly conducted labors, miscarriage, subinvolution, insufficient rest following confinement, exposure to cold and wet at the time of menstruation, a large number of pregnancies, anemia, and subinvolution of the uterus.

Symptoms.—There is a heavy, dull pain in the lumbar region, and extending down the thighs. This pain is increased by the upright position, in which case pains may be experienced also in various other parts of the body. A frequent accompaniment is hemorrhage, either at the time of menstruation, or between the menstrual periods. When the condition is due to anemia, amenorrhea may result. Vertigo and frontal headache are common symptoms. A leuchor-

rheal discharge is a constant feature of this condition, and when due to disease of the cervix, the discharge is thick and gelatinous, while when it is from the body of the uterus it is thin and watery. If the condition is due to sepsis or to gonorrhea the discharge is yellowish or greenish. Gastro-intestinal and nervous disorders are common in this condition.

Adjustment.—The first consideration should be measures directed toward the improvement of the general health, and prolonged rest. Adjust the 1st, 2nd or 3rd lumbar vertebra.

Acute Metritis

Etiology.—Inflammation of the muscular coat of the uterus is primarily due to a low grade of resistance, due to faulty innervation, which renders it susceptible to the invasion of the contributing causes which are in most instances of an infectious nature. Such causes may be gonorrheal. The infection may also be due to retained clots, or pieces of the placenta, or to the use of unclean hands or instruments. It also follows exposure to cold and wet during the menstrual period. It is sometimes an accompaniment of acute infectious diseases, and is also seen in tuberculosis and Bright's disease. Metritis never occurs independently, but generally is the result of extension from an inflammation of the endometrium, or the peritoneum.

Symptoms.—The disease usually commences suddenly, with a chill. This is followed by a rapid rise in temperature, and an increase in the pulse rate. There are nausea and vomiting, and frequent urination and diarrhea. Pain is a constant feature, and is experienced in the hypogastric region over the uterus, and also in the lumbar region and iliac region. The uterus is soft and enlarged. Hemorrhages frequently occur.

Adjustment.—Absolute rest in bed, and if the case is seen early, cold compresses over the uterus, while if seen later, hot applications are indicated. Adjustments of the 1st, 2nd or 3rd lumbar vertebra. If the condition is due to retention of particles of placenta or clots, removal thereof by surgical means may be necessary.

Chronic Metritis

Etiology.—The cause of chronic metritis is a prolongation of the causes of the acute form, when left unattended.

Symptoms.—The characteristic symptoms of chronic metritis are a constant heavy pain in the hypogastric, lumbar and sacral regions, and extending down the thighs. Vertigo and occipital headache are constant symptoms of this condition. Painful and profuse menstruation occur, and at other than the menstrual time there is a leucorrheal discharge. Frequent micturition and diarrhea, owing to irritability of the bladder and rectum, are common symptoms. Various nervous diseases, such as hysteria and neurasthenia, frequently are noticed. There is either complete sterility, or if pregnancy occurs, abortions are the rule. During the acute stages of the affection the uterus is enlarged and tender, but later it becomes reduced in size owing to replacement of muscular tissues by fibrous connective tissue. Displacements of the uterus are commonly seen.

Adjustment.—Adjust the 1st, 2nd or 3rd lumbar vertebra. Attention to diet is an important measure in this condition. The bowels should be kept well regulated. The general health of the patient should be improved in every possible way. Rest in bed during the menstrual period is a good procedure.

Salpingitis

Etiology.—Inflammation of the mucous lining of the Fallopian tubes is most commonly due to gonorrhea. It also follows septic endometritis. Frequently it occurs following excessive exercises, or exposure to cold and wet during the menstrual period.

Symptoms.—The disease occurs in two forms, acute and chronic. During the acute period of the disease there is mild fever, and an acute, heavy pain on the affected side, which is increased by standing or walking. If a tube contains pus the usual symptoms of sepsis are present, and the patient lies on the back, with the thighs flexed upon the abdomen. The characteristic symptoms of the chronic form are pain in the lower part of the abdomen on the side of the affected tube, which is increased by exertion of any kind. Sterility is a common symptom of this condition.

Dysmenorrhea and profuse menstruation and repeated attacks of inflammation of the pelvic peritoneum are common symptoms. If a bi-manual examination be made, the enlarged tube can be felt, and it will also be noted that the uterus is generally posteriorly displaced.

Adjustment.—In simple catarrhal salpingitis the patient should remain in bed for some time. Adjust the 1st, 2nd or 3rd lumbar vertebra. If the case is seen early, cold compresses on the affected side may serve to abort the inflammation. Later hot applications are more useful. In some cases surgical measures are necessary.

Congestion of the Ovaries

Etiology.—The primary and predisposing cause of this condition is faulty innervation of the ovaries, whereby the blood supply therein is increased. Contributing causes are chiefly overwork, especially in young girls at school, together with lack of sufficient exercise and fresh air.

Symptoms.—The most characteristic symptom of this affection is pain in the pelvic region for several days preceding the menstrual period. This pain gradually diminishes, as menstruation becomes established, and finally disappears altogether. The patient is weak and chlorosis is usually present.

Adjustment.—Adjust the 3rd lumbar vertebra. The patient should be given a sponge bath every morning, followed by a brisk rub. Candies and pastries, and highly seasoned foods should be forbidden, and a liberal diet of plain food prescribed. Often it is necessary to remove these patients from school work for some time, and enforce rest and outdoor life.

Acute Oophoritis

Etiology.—Inflammation of the ovaries is due to a great variety of causes, chief among which are extension of an inflammation or infection from the uterus or tubes, such as endometritis, salphingitis, gonorrhea, or septic infection; disturbances of menstruation; also occurs in the acute eruptive fevers, tuberculosis, and various intoxications. In all cases the condition is predisposed to by deficient innervation of the involved structure.

Symptoms.—The characteristic sign of this infection is an acute, sharp pain over the iliac region of the affected side, and radiating down the back and thighs. Accompanying this there is marked tenderness over the inflamed ovaries. Alternating chills and fever, and a rapid pulse are present.

Adjustment.—Adjust the 3rd lumbar vertebra. The patient should be confined in bed, and an ice-bag should be applied on the affected side, if the condition is seen early, while later on hot applications are more beneficial. The bowels should be regulated by adjustments and a liquid diet should be prescribed.

Chronic Oophoritis

Etiology.—The cause of this condition is faulty innervation of the ovary, due to the continuance of the subluxations which were reflexly induced during the course of the acute form, and left uncorrected. Chronic inflammation of the ovary also accompanies amenorrhea and various unnatural acts, in respect to the sexual organs.

Symptoms.—The characteristic symptoms of this affection are a continuous dragging pain over the affected ovary, and radiating back to the lumbar region, along the spine, and down the thighs. Headache is a constant symptom of this affection. Rectal and vesical irritation are present, and pain is experienced on urination and defecation. If both ovaries are diseased, sterility results. Various forms of neurosis develop, especially hysteria. The menstrual flow is profuse, amounting sometimes to an actual hemorrhage.

Adjustment.—Adjust the 3rd lumbar vertebra. During the menstrual period the patient should remain in bed. The bowels should be regulated.

Pelvic Peritonitis

Etiology.—Inflammation of the pelvic peritoneum and cellular tissue is commonly a result of an inflammation of the uterus, tubes and ovaries, and most usually a septic inflammation of the tubes. Other causes are gonorrhea, and direct septic infection, from unclean hands, instruments, etc.

Symptoms.—Pelvic peritonitis may be either acute or chronic. In the acute form the onset is sudden, with a chill

and pain and tenderness over the hypogastric region. The patient lies in the dorsal position, with the thighs flexed on the abdomen to relieve as much as possible the muscular tension, and thus the pain. The abdomen is distended and tympanitic; there is constipation, irritability of the bladder, and sometimes nausea and vomiting.

The symptoms of the chronic form of pelvic peritonitis are a dull, aching, dragging pain in the pelvic region, disorders of menstruation, leucorrhea, and irritability of the bladder and rectum.

Adjustment.—Adjust the lower dorsal and upper lumbar vertebrae. In acute cases rest in bed is essential. A liquid diet should be prescribed, and the bowels regulated.

CHAPTER XIV

Diseases and Injuries of the Spine and Deformities

Scoliosis

Etiology.—The principal causes of lateral curvature of the spinal column are the following: Rickets in young children may frequently cause a lateral curvature on account of the softened condition of the bones. Occasionally the condition may be congenital, as a result of faulty development of the vertebrae; frequently it is caused by carrying infants on the one arm and in the same position at all times; other anatomical deformities, such as shortness of one leg, dislocation of the hips, genu valgum, contraction of one side of the chest as a result of empyema, and a long standing torticollis; if the lateral curvature is due to shortening of one of the legs, the pelvis is tilted downward on the side of the shorter limb and results in a lateral curvature in the lumbar region, with its convexity toward the shortened extremity; at the same time a compensatory curve forms in the dorsal region in the opposite direction. When the curvature is due to empyema, it is located primarily in the dorsal region, with its concavity towards the affected side of the chest. In torticollis the curve is situated in the cervical region, and a compensatory curve follows in the dorsal region. Another frequent cause of lateral curvature is standing or sitting in an incorrect position, namely, throwing the weight chiefly on one leg when standing, or leaning constantly to one side while sitting. Another frequent cause of lateral curvature is a depraved systemic condition which is present so frequently about the age of puberty, as a result of rapid growth of the individual, combined with improper food, poor hygienic surroundings, or overwork. This deformity of the spine is also seen in young women suffering from chlorosis and amenorrhea, whose occupation requires them to do a great deal of lifting.

Symptoms and Signs.—The nature and extent of the deformity varies considerably in different cases. The most

common condition is the presence of two curves, one of which is primary, and is due to the cause of the affection, while the other is a compensatory curve, formed for the purpose of maintaining the upright axis of the body. The form which is usually seen is a curvature in the dorsal region with the convexity toward the right side, and a compensatory curve, in the opposite direction, in the lumbar region. In connection with the lateral displacement of the vertebrae there is present rotation of the vertebrae in the affected region. This rotation is toward the side of convexity of the curve. As a direct consequence of this rotation, the spinous processes of the vertebrae are directed away from the convexity, and consequently minimize the apparent extent of the deformity. Other portions of the body also participate in the deformity. The ribs on the side towards which the convexity of the curve is directed are separated from each other, and are more prominent on that side, as a result of the rotation of the vertebrae. At the same time the ribs on the affected side are depressed, and the front of the chest consequently is flat. On the opposite the ribs are pressed toward each other, the scapulae are displaced in the same direction that the thoracic wall is, and consequently the shoulder on the side of the convexity of the curve is raised while that on the other side is lowered. On the side toward which the curve is directed, the hip is lower, and sunken in, while on the opposite side the hip is raised and thrown out. The erector spinae muscle on the side of the concavity of the curve stands out very prominently, and the transverse processes on this side are also plainly seen in many cases. In the early stages of the condition the spine may be made to appear perfectly straight by extension of the trunk; as the condition progresses, however, ankylosis slowly develops, and the curve becomes fixed.

Adjustment.—The first requisite is the determination of the cause and measures directed towards removal thereof. If, for example, it is found that the condition is due to general debility, the patient's health must be improved by means of a nutritious diet, well regulated exercises and hygienic measures. If the condition is due to faulty habits

of standing or sitting, these must be corrected. Again, if it is due to shortening of one of the limbs, it will be necessary to wear a high-heeled boot until the adjustments have restored it to its normal position.

Kyphosis

Etiology.—An increase of the dorsal convexity of the spine is very frequently associated with a marked increase in the lumbar curve, so that lordosis is present, which is a compensatory curve.

This condition is seen frequently in various diseases of the spinal column, especially tuberculosis, syphilis, and cancer. It also follows fractures of the spine. It is seen frequently in children under the age of five years, and is in such cases a result of rickets. In youthful persons, up to the age of eighteen, it is commonly known as round-shoulders, and is brought about by a habit of bending forward, as in reading or writing. Different occupations predispose to this form of deformity, such as those which necessitate the carrying of heavy loads, or work which requires constant stooping forward. In the aged it is a compensatory curve to prevent the complete closure of the intervetebral foramina, the vertical diameter of which is markedly diminished by the compression of the intervertebral discs.

Symptoms.—The symptoms of this condition have been described in the chapter dealing with the various forms of subluxation, and the reader is referred to that chapter.

Adjustment.—In many cases anklyosis of the vertebrae has taken place, and in such it is not advisable to attempt to break the ankylosis. This is especially true if the spinal deformity is a result of tuberculosis. In many of these cases the focus of tuberculosis is still present, though not active, and attempts at breaking the ankylosis very often produce a reaction of inflammation and again light up an active tuberculosis. In the aged, a kyphotic curve is really physiological, and should not be interfered with. When due to various occupations, its occurrence has been so gradual, and the curves of the spine have adapted themselves to the changed position, and it is therefore inadvisable to attempt to change them. Where ankylosis has not occurred, it is possible to do a great deal toward the correction of

this deformity by means of extension. At the same time individual subluxations should be corrected as indicated. In some cases surgical measures are indicated.

Round Shoulders

Etiology.—This condition is seen most commonly in young girls who have grown very rapidly, and developed early. It is usually brought about by faulty habits of standing or sitting, while defective vision and adenoids may also be producing factors. The spine becomes bent forward in the lower cervical and upper dorsal region, while the shoulders are also thrown forward and the chest is narrowed.

Adjustment.—The first essential is to ascertain the cause of the condition and correct it. The general health must receive attention, and plenty of fresh air and a good, nourishing diet must be provided. Girls affected in this way should never exercise to excess and should spend several hours a day in the dorsal position; at night they should lie on the back with a pillow placed beneath the curve. The muscles of the back should be strengthened by means of well-directed exercises in connection with the adjustment of subluxated vertebrae.

Lordosis

Etiology.—Lordosis is seen most commonly in the lumbar region of the spine. It is commonly a compensation curve in cases of kyphosis. It is very often due to congenital dislocation of the hip, or to diseases of the hip-joint. A physiological lordosis occurs in pregnancy; large fibroid tumors of the uterus also occasion this curve, owing to the necessity of the patient throwing backward the upper part of the spine, in order to maintain the center of gravity of the body. A similar condition is produced in the same way in individuals with a large, pendulous abdomen.

Adjustment.—The measures outlined under scoliosis apply in general to this condition and appropriate adjustment should be made.

Spondylolisthesis

Etiology.—This is a deformity in which the lumbar group of vertebrae are displaced forward and downward up-

on the sacrum. Most commonly the 5th lumbar alone is thus displaced, which, in reality, constitutes a postero-inferior subluxation of this vertebra. When, however, the term "Spondylolisthesis" is used, it is meant to imply that the entire group of lumbar vertebrae are displaced anteriorly and downward. The condition is most commonly produced by the carrying of heavy loads upon the shoulders. The increased weight of the uterus during pregnancy may also produce this deformity.

Symptoms.—There is a diminution in the height of the individual, and a depression is present above the sacrum, while at the same time the lumbar group of vertebrae are seen displaced anteriorly. Weakness of the lower part of the back, and neuralgic or rheumatic pains are present.

Adjustment.—When only the 5th lumbar vertebra is affected, a thrust upon the sacrum towards the feet may alone suffice to correct it. Sometimes an adjustment of the 4th lumbar vertebra in the direction of the head is also necessary. In connection with this, prolonged rest may also be of assistance in obstinate cases.

Sprains of the Spine

Etiology.—Sprains of the spine are exceedingly common injuries, and are responsible for a great number of the subluxations, which subsequently are followed by a train of diseases and disorders, whose nature depends upon the region of the spine affected. They are produced by any sudden or unlooked-for movements, such as falls, jars, twists, and other movements. The cervical and lumbar regions of the spine are most apt to be affected by sprains. In some cases no actual subluxations are produced, and the injury is simply ligamentous at the commencement, but later on subluxations are produced as a result of the contraction of the ligaments on one side.

Symptoms.—The characteristic symptoms are those of subluxation, namely, displacement of a vertebra, contraction of the ligaments, local heat, tenderness of the nerve, and possibly thickening of the nerve trunk. There may also be evidences of trauma, and especially bruising of the surface, and swelling of the soft tissues. Sprains of the spine may be very simple, or they may be extremely severe; thus

merely the muscles and the interspinous ligaments may be involved, and no further disorders follow. On the other hand the ligamenta subflava may be torn and the spinal canal laid open, in which case grave symptoms will follow by reason of the blood finding its way into the spinal canal, and producing pressure upon the cord. In persons of a tuberculous diathesis, Pott's disease may develop. Sprains of the cervical portion of the spine are usually a result of violent blows upon the head, and as a result of rupture of the intertransverse ligament, marked displacement of the vertebrae may be occasioned, and is sometimes so severe as to resemble an actual dislocation. The head and neck are held perfectly rigid, and the patient is unable to move the head in any direction. Sprains in the lumbar region of the spine are seen very frequently in railway injuries, and are also a result of overlifting. In these cases the back is held rigid, and the patient is unable to turn or bend forward or stoop without experiencing severe pain.

Adjustment.—If the patient is seen early after the injury has occurred, absolute rest is indicated and hot applications should be used over the affected parts of the back as they afford great relief to the patient. As soon as inflammation has subsided, and the pain has diminished, adjustments should be made as indicated. This should be followed by the use of massage. In aggravated sprains which involve the cord, cold compresses should be used constantly, and the patient placed in a prone position. In all cases adjustment should be made as soon as possible after the occurrence of the injury.

Dislocations of the Spine

Etiology.—A dislocation of the spine is a complete separation of its articular processes, and all its contiguous surfaces. It differs from a subluxation in this, namely, that in the latter there is only a partial misplacement of the contiguous surfaces. Many dislocations are accompanied by fracture; in the cervical region, however, a pure dislocation can occur without being associated with a fracture. The reason that dislocations may occur in the cervical region without fracture is due to the shape and placement of the articular processes, which in this region are flat, and slope backward

and forward, and look upward and downward, so that it is easily possible for one to slip over the other. In the dorsal region, and lumbar region, however, complete dislocation without fracture is scarcely possible, for the reason that in the dorsal region the surfaces of the articular processes are nearly vertical and look forward and backward; in the lumbar region they are also placed vertically, and are directed inward and outward respectively, and fit into each other very accurately.

Since a pure dislocation is seen most commonly only in the cervical region, dislocations of the dorsal and lumbar region will not be considered here, but will be described under the consideration of fractures of the spine. A dislocation may be located in any part of the cervical region; thus, the atlas may be displaced from the occipital bone, and if complete, death results at once. A dislocation between the atlas and axis is the common cause of death in hanging, and also occurs following blows on the neck; in nearly all these cases the transverse ligament is torn, or the odontoid process is fractured, death resulting from compression of the medulla. Any of the other five cervical vertebrae may be displaced from each other, most commonly the 5th and 6th. It is usually produced by violent bending backward of the head and neck, in connection with rotation, in which case the injury to the surrounding soft parts is very extensive.

Dislocation of this kind may involve either one side of the affected vertebrae, or it may be bi-lateral.

Symptoms.—In a unilateral dislocation the head is turned away from the dislocated side, and is held rigid, and no symptoms of injury of the cord are present. The consequent pressure of the margins of the intervertebral foramina upon the nerves, produces prickling sensations, and neuralgic pain along the course of the nerves. The spinous processes of the affected vertebrae are displaced to one side and the transverse processes are similarly affected. If the condition is not corrected at once, it becomes permanent and various disorders ensue, depending upon the location of the dislocation.

In a bi-lateral dislocation there are always present symp-

toms of pressure upon the cord, such as paraplegia.

Adjustment.—In severe cases the patient should be anaesthetized in order to produce complete relaxation of the surrounding ligaments. The dislocation is then corrected by the characteristic chiropractic thrust.

Fractures of the Spine

Etiology.—Fractures of the spine are a result of direct or indirect violence. They are of two kinds, complete and incomplete. Complete fractures are usually associated with dislocation, and are often referred to as fracture-dislocations.

Complete fractures may be produced by direct or indirect violence. The lesions produced may be of various kinds: Any portion of the body of the vertebra may be fractured, or the injury may involve any of the processes of the vertebra. The lower fragment is usually fixed, while the upper fragment is movable and is forced forward over the lower. In nearly all cases the spinal cord is seriously injured by being crushed. In some cases, however, the injury consists merely in a puncturing of the meninges by a splinter of bone, or it may consist in a hemorrhage of the meninges.

Incomplete fractures are of various kinds, and are usually due to direct violence. Fracture of the spinous processes occurs most commonly in the lower cervical and in the dorsal regions of the spine. In the cervical region the upper cervical spinous processes are very short, while in the lumbar region they are also short and in addition to this fact, are very strong. Fracture of the laminae is not unusual; if both laminae are fractured there is a forward displacement of the upper fragment and a crushing injury of the spinal cord ensues. If only one lamina is fractured, the cord is usually left uninjured, and the signs of the fracture are indistinct. Fracture of the transverse processes alone is an uncommon injury. Fractures of the bodies of the vertebrae when incomplete are accompanied by no displacement of the fractured portion, and little after effects result.

Symptoms.—The signs of a complete fracture are pain, swelling, deformity, crepitation, shock and paraplegia. The signs of incomplete fracture are pain, swelling, increased

mobility, and sometimes crepitation, together with malalignment of the spinous processes in some instances.

The treatment of a complete fracture consists first of all in placing the patient on a hard bed, which is perfectly level. When the patient is seen immediately after the injury has occurred, the greatest care should be exercised in moving him so as not to aggravate the displacement of the fractured portions. Severe shock should be met by the use of warm applications and stimulants. When the reaction of inflammation and the severe pain have somewhat subsided, a careful analysis of the spine should be made. Reduction under an anesthetic will suffice to replace the fractured fragments. Following this complete rest in bed should be had for a long period of time, during which careful attention should be given to the condition of the skin, bowels and bladder. The tendency toward bed-sores is marked, and everything should be done to harden the skin, and thus prevent their occurrence. The bladder is very often paralyzed, and the urine must be withdrawn by means of a catheter. The bowels have a tendency toward constipation and daily enemata are necessary.

The treatment of incomplete fractures consists chiefly in keeping the patient at rest for a prolonged period, during which time union of the fractured portions takes place.

Tuberculosis of the Spine (Pott's Disease)

Etiology.—Tuberculosis of the spine is caused primarily by a low grade of resistance, due to faulty innervation, by reason of which the individual is predisposed to the contributing causes of the disease, which are infection by tubercle bacilli. Usually the actual occurrence of the disease process dates from the time of an injury; this injury may not be sufficient to occasion any trouble at the time, and no symptoms may develop until six months to a year after the occurrence of the traumatism. Tuberculosis of the spine is seen most commonly in children, but may occur at any age. It may affect any portion of the spinal column, though the lower dorsal region is most commonly involved.

Pathology.—The disease process commences in the bodies of the vertebrae, and spreads to neighboring vertebrae either along the under surface of the anterior common ligaments, or by way of the intervertebral discs. When the

process extends along the anterior common ligaments many vertebrae may be affected, and the deformity which results is in the nature of a kyphosis. When the process extends along the intervertebral discs, it is not so extensive, fewer vertebrae are involved, and an angular deformity results. The active process is finally terminated by the bodies of the vertebrae collapsing and becoming ankylosed, resulting in a deformed and immovable condition of the involved portion of the spine.

Symptoms.—The characteristic symptoms of Pott's disease are pain, which is continuous, and of two kinds: First, a local pain which is experienced at the site of the lesion and is of a boring nature; second, referred pain, which is felt at the terminals of the spinal nerves which are impinged as they emerge through the intervertebral foramina. Spinal rigidity is a constant symptom of Pott's disease, and in the early stages is due to the muscular contraction, which accompanies the local inflammation. In all cases deformities result, as above described, the patient's stature is much diminished, the sternum is thrown forward, the upper ten ribs are approximated so that the intercostal spaces are practically obliterated, while the lower two ribs are in their normal position, and a horizontal groove is thus formed on a line with the 10th rib. The most serious effects of tuberculous disease is abscess formation. The abscess is not felt until it has reached a considerable size and has burrowed for some distance into surrounding structures and parts.

The treatment of Pott's disease consists in complete immobilization of the spine, together with the application of a mechanical support, which has for its object the removal of the weight of the body from the affected portion of the spine. For the technique of the various methods of immobilizing the spine, the reader is referred to text-books on surgery.

Syphilitic Disease of the Spine

Symptoms.—Syphilis of the spine occurs in the tertiary stage of syphilis, and consists of the deposition of gummata on the bodies of the vertebrae beneath the periosteum. The general symptoms are similar to those of tuberculosis of the

spine. The lesion occurs most commonly in the cervical region of the spine.

The treatment consists in the use of eliminative measures, rest, and the application of a spinal support.

Rheumatic Spondylitis

Etiology.—This condition is the same as that occurring in any portion of the body affected by rheumatism. The ligaments and muscles of the spine are usually affected, although the intervertebral discs may also be the seat of rheumatic inflammation. It is most commonly noted in the cervical region.

Symptoms.—The movements of the head and neck are much impaired, and lateral deflection of the neck, such as occurs in torticollis, is often present. In cases which are left untreated, ankylosis finally develops.

The adjustment is the same as that for rheumatism in any portion of the body.

Osteoarthritis of the Spine

Symptoms.—Osteoarthritis may affect the entire vertebral column, and ankylosis usually occurs. In most cases kyphosis develops, and intense pain is present due to the pressure of the bony outgrowths upon the nerve roots. The condition may remain confined to the spine or may extend to other portions of the body.

The adjustment of osteoarthritis of the spine is the same as that of the disease in other portions of the body.

Acute Osteomyelitis of the Spine

Etiology.—The primary and predisposing cause of this affection is a low-grade of resistance due to faulty innervation. The direct cause is an infection with pus-producing organisms, in the face of this low resistance.

Symptoms.—The characteristic symptoms of osteomyelitis of the spine are pain of an intense and boring character in the affected portions of the spine and radiating over the back; alternating chills and fever; early in the course of the disease abscesses develop, which may burrow into the spinal canal, which is a common complication.

The management of this affection is limited to surgical measures.

Genu Valgum (Knock-knee)

Etiology.—There are two varieties of this deformity: First, that form which is seen in young children, and which is due to rickets; second, that form which is seen in individuals under the age of 20 years, and which is due to general debility, and in addition is brought about by the carrying of heavy weights, being seen especially in nursemaids, janitors, etc.

Symptoms.—The thighs approach each other until the knees touch, while the patellae look forward, and at the same time the legs are in a state of fixed abduction. One or both limbs may be affected, although if the condition is due to general causes, both limbs are usually affected.

Adjustment.—In children suffering from rickets the treatment is confined principally towards the correction of that disease. For this purpose plenty of fresh air, hygienic measures, and a nourishing diet are indicated. At the commencement the patient should be confined to bed, and massage, passive movements, and manipulation used in order to straighten the limb. At the same time adjustments should be made. When the deformity has existed for a long time, or is very marked, various corrective appliances or even surgical measures are necessary to produce a cure.

Talipes (Club-foot)

Etiology.—This deformity may be either congenital or acquired.

The congenital form may result from faulty development of the bones of the foot or leg, or from a deficiency in the amount of amniotic fluid, as a result of which the feet are held in one position. This form is often hereditary and is seen in several members of one family.

The acquired form is frequently due to infantile paralysis, contraction of muscles following burns or infection, long continued spasm of the muscles, shortening of the leg from hip or knee disease, the habit of standing with the foot in an awkward position, and diseases of the main peripheral nerves.

Symptoms.—Four main forms of Talipes are commonly seen: First, Talipes Varus, in which the front half of the

foot is adducted, while its inner side is elevated, the patient thus walking on the outer side. Second, Talipes Valgus, in which the front half of the foot is adducted and turned out, so that the patient walks on the inner side of the foot. Third, Talipes Equinus, in which the heel is drawn up, so that the patient walks on the toes. Fourth, Talipes Calcaneus, in which the toes are raised from the ground, and the patient walks on the heel. Various combinations of these forms may be seen.

In the congenital variety attention should be given the condition as soon after birth of the child as possible. The foot must be manipulated daily into a good position, in addition to which forcible attempts should be made at correction. The muscles of the foot and leg should be massaged thoroughly. Later on mechanical appliances and the use of surgical measures are often necessary. When the condition is due to infantile paralysis, adjustments and massage are the proper measures to be used. The other form should be corrected by manipulation, massage and adjustments, and those cases which will not respond to this method of treatment should be referred to the surgeon.

Flat-foot

Etiology.—This deformity is seen chiefly in young adults whose occupation requires them to spend long hours standing on the feet. It is also a result of a general muscular relaxation and loss of tone which follows debilitating diseases or is predisposed to by reduced innervation of the plantar muscles of the foot. It is seen more commonly in long than in short feet, and it seems to be a natural condition among some of the negro races.

Symptoms.—In the early stages of the condition the patient complains of weakness and fatigue along the inner side of the foot or ankle. Later on the gait becomes shuffling and marked pain is present over the entire foot. The sole of the foot is flat, and in advanced cases is in contact with the floor throughout its entire extent. A diagnosis of the condition can readily be made by having the patient stand on a piece of smoked paper and obtaining the imprint of the foot.

Adjustment.—In the early stages, before the deformity

has become fixed, the first consideration is rest of the affected feet. This permits the exhausted and over-strained ligaments and muscles to regain their normal strength and tonicity. At the same time the parts should be thoroughly massaged and manipulated, in order to build up the arch of the foot again. Exercises should be used, the best of which consist in having the patient raise himself on the toes, and move up and down 20 times without permitting the heels to strike the floor. This should be done every morning and has for its object the strengthening of the plantar muscles. In addition to these measures adjustments in the lumbar region prove successful. The patient should wear proper shoes, and if necessary, an arch should be inserted to support the foot. If the deformity is fixed, surgical measures may be necessary to forcibly correct it.

Torticollis

Etiology.—Torticollis or Wry-neck is a deformity due primarily to a contraction of the sterno-mastoid and trapezius muscles of one side, as a result of irritation of the nerves which control them. It is secondarily due to exposure to cold, rheumatism, and hysteria.

Symptoms.—The affected side of the head is drawn down toward the shoulder, and at the same time the face is turned away therefrom. The cervical portion of the vertebral column is scoliotic, with the concavity of the curve directed toward the affected side. Coincidentally with this, a compensation curve forms in the dorsal region, which is chiefly for the purpose of maintaining the eyes at the same level. Later on the muscles of the affected side of the face and neck become atrophied.

Adjustment.—Adjust the upper cervical vertebrae that are found subluxated.

Diseases of the Joints

For a detailed discussion of the various diseases of the joints, the reader is referred to text-books on surgery. It may, however, be mentioned in this connection, that vertebral adjustment is often extremely successful in the treatment of various joint affections, and should in all cases be used.

CHAPTER XV

Diseases of the Skin

Many of these cases belong to the specialist, and should be referred to a dermatologist. There are a number of dermatoses, however, which respond to methods other than the use of drugs and these can be successfully managed by the general practitioner.

In the consideration of this subject it will be necessary to confine ourselves to generalities since it is obviously impossible in a work of this nature to give a detailed description of each disease. Skin diseases have been so minutely classified and so variously named that skill in diagnosis of each individual disease can be acquired only by long experience.

The management of these cases is identical in many cases, and varies with the nature of the local lesions, the acuteness or chronicity of the condition, and whether systemic or local in origin; symptomatic measures are often indicated.

Etiology.—Diseases of the skin are due to a great variety of causes, the most important of which is subluxation of the vertebrae by which the innervation of the skin is made deficient. As a result of this, it suffers nutritional disturbances, its functional activity is impaired, and the low grade of resistance which is thereby induced, renders it susceptible to the invasion of the contributing causes, which are as follows:

The contributing or exciting causes of skin diseases are of two classes: First, internal; second, external.

The internal causes of dermatoses are, first, drugs, foods, bacteria, and infections. Second, various neuroses, reflex nervous derangements and emotional disorders. Third, nutritional disturbances.

The external causes of skin diseases are chemical, thermal, mechanical, and parasitic.

Other predisposing causes to various dermatoses in addition to general impairment of the health as a result of

subluxations, are, first, age; second, sex; third, nationality or race; fourth, climate and seasons; fifth, occupation and mode of living; sixth, susceptibility, predisposition, diathesis, or idiosyncracies of the individual.

Symptoms and Diagnosis.—"Extent of surface involved —In making the general inspection, attention must also be paid to the amount of surface involved and to the localities occupied by the eruption. In addition to the illustration just given, it should be recalled that exanthemas usually cover the whole body; that the early syphilids are widely distributed; that acne is seated upon the face and shoulders; that psoriasis is likely to be symmetrically disposed; and that tinea versicolor is found on the trunk, xanthoma on the lids, lupus and epithelioma generally on the face, and lupus erythematosus on the nose and cheeks.

Arrangement of Lesions.—It is important to know whether the lesions occupy one or both sides of the body, and whether they possess any special arrangement. For example, in zoster the eruption is unilateral and the eruptive elements follow the course of cutaneous nerves, displaying clusters of vesicles on a red base. In ringworm the lesions affect a ringed arrangement, and extend at the periphery while clearing in the center. This disposition is also to be noted in psoriasis and in some syphilids; herpes iris is annular. Moreover the eruption in syphilis is often grouped—a feature also to be observed in dermatitis herpetiformis; but the first-mentioned affection presents no marked subjective symptoms, whereas in the latter there are intolerable itching and burning.

Color.—The color of an eruption is often at least an auxiliary aid to diagnosis. The brownish-red or ham color of some syphilids differs from the underlying brighter red of psoriasis, and it also may be said that the thick greenish crusts of syphilis are fairly characteristic. The favus cups are sulphur-yellow; the patches of tinea versicolor are of a fawn-tint; keloidal tumors are pinkish; and the new growths of xanthoma are buff-colored. In the same way the shade of color presented by an inflammation of the skin will measurably indicate its acute or chronic character.

Touch.—The affected skin should also be pinched up between the fingers, or in order to get as accurate an idea as

possible of the amount of infiltration present, the special tissue involved, the temperature, the presence or absence of fluctuation, etc. An account of the symptoms revealed by the educated touch will often determine whether a disease is superficial or deep-seated, and thus eliminate whole groups of disorders from the field of discussion.

Odor.—The odors arising from certain diseases of the skin are at times helps to their diagnosis. Favus has a peculiar mouse-nest smell; syphilitic ulceration emits a nauseating stench that is suggestive; while the smell of gangrene is well recognized.

Acute or Chronic.—The objective aspect of the disease is indicated by these terms rather than the time occupied in its development, the latter point receiving notice more particularly when the previous history of the case is under inquiry. For example, an eczema may have an acute appearance although a long time in existence, while a syphilid may be of recent origin yet lack all evidence of acuteness. Any changes that may have occurred, such as crusting, scarring and the like, should be carefully noted, and the extending or outer margin of a patch should be especially observed, as often in this way we may detect the primary lesions (e. g., in lupus) of an eruption that has been disguised by complications of treatment.

Individual Lesions.—It so happens that diseases of the skin, whatever may be their cause or nature, impress themselves upon the integument by certain elementary forms called primary lesions, which have been justly termed the alphabet of dermatology; and there are also to be observed certain other manifestations that are partly the sequels of the initial processes or are the effect upon them of traumatism—these are termed secondary lesions. The primary lesions consist of macules, papules, vesicles, blebs, pustules, tubercles, wheals and tumors.

Macules are discolored patches of skin, of variable shape and size, without elevation or depression.

Papules are circumscribed solid elevations of the skin, varying in size from that of a pinhead to that of a pea.

Vesicles are pinhead-sized to a pea-sized circumscribed elevations of the epidermis, containing clear or opaque fluid.

Blebs are round or irregular shaped pea-sized to egg-

sized elevations of the epidermis, containing clear or opaque fluid.

Pustules are circumscribed, flat, or accuminate elevations of the epidermis, containing pus.

Wheals are edematous, circumscribed, irregular, pinkish elevations of the skin, transitory in character.

Tubercles are circumscribed, solid, deep-seated elevations of the skin, attaining or exceeding the size of a pea.

Tumors are variously sized and shaped prominences, having their seat in the corium or subcutaneous tissue.

The secondary lesions comprise scáles, crusts, excoriations, fissures, ulcers, scars, and stains.

Scales are dry epidermal exfoliations shed from the surface of the skin.

Crusts are brownish or yellowish masses of dried exudation.

Excoriations are epidermal denudations, usually the result of local traumatism.

Fissures are linear cracks or wounds in the epidermis or corium due to disease or injury.

Ulcers are round or irregular losses of tissue involving the skin and subcutaneous tissue.

Scars are connective tissue, new formations occupying the region of former losses of tissue.

Stains are discolorations of the skin left after the disappearance of cutaneous lesions.

While it is absolutely necessary for one desiring a knowledge of dermatology to know thoroughly these pathologic processes, it is not claimed that the recognition of a primary or secondary lesion will immediately give a clue to the diagnosis; for it is well known that these lesions are due to the most varied morbid states, and that the same kind of lesions will often be found in very dissimilar diseases. If, however, the type of the lesion has been determined, at least the field of investigation has been considerably narrowed. For instance, it is of decided advantage to be aware that in herpes zoster there are vesicles and not tubercles; that in disorder presenting macules we have not to deal with pemphigus or acute urticaria, for these affections are characterized by an entirely different order of lesions. The same reasoning holds

good, in a measure, for secondary lesions, such as crusts, ulcers, scars, scales, etc.

Macules occur in chloasma, eczema, erysipelas, roseola, rubeola, scarlatina, rötheln, erythema, ephelis, leukoderma, melanoderma, tinea, versicolor, syphilis, xanthoma, purpura, naevus pigmentosus, and morphea. When a large portion or the entire skin is involved by change of color, it is known as a discoloration; such, for example, as is seen in Addison's disease, leprosy, and argyria.

Papules are observed in acne, milium, comedo, eczema, lichen, prurigo, in certain kinds of purpura and urticaria and in variola, keratosis pilaris, ichthyosis, and miliaria papulosa. The eruptions of measles and rötheln are really maculopapular in character. In syphilis the papule is often surrounded by a scale.

Tubercles are found in connection with syphilis, leprosy, parasitic sycosis, acne, molluscum epitheliale, and lupus.

Tumors exist in carcinoma, sarcoma, syphilis, elephantiasis, angioma, keloid, lipoma, fibroma, and erythema nodosum.

Vesicles are present in eczema, herpes, vaccinia, sudamen, miliaria, varicella, dermatitis, dysidrosis, scabies; vesicopustules are observed in impetigo contagiosa, the vesicular syphilid, etc.

Blebs occur in pemphigus, hydroa, erysipelas, herpes iris, leprosy, syphilis, and dermatitis.

Pustules are encountered in acne, variola, ecthyma, equinia, impetigo, scabies, syphilis, sycosis, dermatitis, and pustula maligna.

Wheals are found in connection with irritable states of the skin, such as occur from the bites of insects and most typically in urticaria, and also in some degree with purpura and erythema multiforme.

Scales are observed in psoriasis, eczema, pityriasis rubra, exfoliative dermatitis, scarlet fever, measles, seborrhea, the vegetable parasitic affections, and ichthyosis.

Crusts are to be found in eczema, syphilis, scabies, ecthyma, scrofuloderma, leprosy, impetigo, carcinoma, seborrhea, herpes zoster, and sycosis.

Fissures occur in eczema, psoriasis, syphilis, ichthyosis, verruca.

Excoriations are to be seen in pruriginous disorders, such as eczema, pruritis, pediculosis, scabies, etc.

Ulcers appear as sequels to the lesions of syphilis, lupus, boils, carbuncles, eczema, herpes zoster, scrofulo-derma, epithelioma, sarcoma.

Scars come in the wake of ulcerative skin-diseases; e. g., lupus vulgaris, syphilis and lupus erythematosus.

Having now closely observed all that the eye, the touch, the sense of smell, etc., can reveal—in other words, having made, free from preconceived notions, a thorough study of the objective symptoms present—we are better prepared to ascertain the general history of the case, to obtain an account of the patient's own sensations, and, finally, to make use of the various collateral methods of diagnosis that science has placed at our disposal.

Locality.—Many diseases have distinct predilections for special localities. Psoriasis elects the scalp and the extensor surfaces of the elbows and knees. Eczema may occur anywhere, but prefers the flexor surfaces. The excoriations of pediculosis corporis are seen across the shoulder-blades and around the waist. Acne attacks the face and chest. The lesions of scabies are quiet constantly present on the webs and sides of the fingers, the flexor surfaces of the wrists, the anterior and posterior axillary folds, the nipples, the umbilicus, and penis, the buttocks, the inner sides of the thighs and legs, and the toes (in infants). The face is always exempt, except in infants. Erythema multiforme attacks the face, the neck, and the back of the hands and feet. Erythema nodosum is usually situated on the anterior surfaces of the tibias. The proneness of common affections to attack special localities is indicated in the following list:

Scalp—Eczema, ringworm, pediculosis capitis, favus, seborrhea, alopecia areata.

Face—Acne, eczema, lupus vulgaris, lupus erythematosus, syphilis, impetigo, sycosis.

Chest—Tinea versicolor, seborrheic eczema, macular syphiloderm, acne.

Shoulders and Back—Acne, carbuncle, pediculosis corporis.

Buttocks—Furuncles, scabies, congenital syphilis, eczema intertrigo.

Genitals—Eczema, pruritus, herpes simplex, scabies, syphilis.

Lower extremities—Purpura, ecthyma, eczema, rubrum, erythema nodosum.

Age, Sex and Social Condition.—Some diseases of the skin are more prone to attack children than adults, and vice versa. Epithelioma usually appears first in middle or advanced life, while lupus vulgaris nearly always dates from childhood. Neither acne nor tinea versicolor is common in children, but ringworm of the scalp shows a predilection for that age and usually spares the adult. Ichthyosis is practically congenital. Lupus erythematosus is more frequent in women, and epithelioma of the lower lip is generally an affection of the male.

A knowledge of the occupation is sometimes a help in diagnosis. Bakers, grocers, bricklayers, plasterers, and barkeepers suffer from eczema, and artisans who handle chemicals and other irritants exhibit various grades of dermatitis. Hostlers may contract glanders, and wool-sorters become infected with anthrax. Pediculosis is more common in the poor and unclean than in the upper classes of society.

Antecedent History.—The past history of the case will inform us as to former attacks of cutaneous or other diseases; and if the information is judiciously elicited, may throw much light on the present condition. This is of prime importance, especially in syphilis.

General Symptoms.—The general symptoms of the patient must not be neglected. His facial expression, his gait, the color of his skin and conjunctivas, the state of the tongue, stomach, and bowels, etc., must be thoroughly investigated. The thermometer will show the body temperature, and microscopic and chemic investigation will determine the condition of the blood and urinary secretion, thus proving or disproving the existence of diabetes, nephritis, and malaria, each of which may be potent factors in the etiology.

Microscope.—Aside from the employment of the microscope in the conditions just mentioned, this instrument is an

invaluable aid in dermatologic practice. With it the character of tumors may be determined and information furnished as to the nature of obscure pathologic processes. It is of especial utility in recognizing the presence of fungi or of animal parasites, and in the investigation of the rapidly extending class of bacillary diseases.

Drug and Feigned Eruptions.—The ingestion of various drugs produces in many persons diverse lesions of the skin, and a careful inquiry should always be made in that direction. The same observation may be applied in regard to certain foods: e. g., urticarial and erythematous rashes are often due to the eating of strawberries or buckwheat, and eczemas are sometimes at least indirectly connected with the free eating of oatmeal. Many plants set up severe dermatitis, and heat and cold and the X-rays are also responsible for similar conditions. The physician should also be fully aware that feigned or artificial eruptions are not infrequently produced upon themselves by hysterics and malingerers.

Subjective Symptoms.—The merely subjective symptoms of a patient are not of paramount importance in diagnosis; still, one must not put aside as of no importance the statements of intelligent persons in matters relating to their own experiences of pain, itching, burning, or other sensations. Very often such statements may be verified by the condition of the integument itself; for example, if itching is severe, the presence of scratch marks will testify to its existence." (Gould and Pyle.)

Adjustment.—The adjustment of skin diseases is divided into two kinds, the internal and the external. The first requisite is the determination of the exact contributing cause of the condition, and then using measures directed toward its removal. The general practitioner is usually called upon to handle such skin diseases as are due to autointoxication, disorders of digestion, and disturbances of metabolism. It is therefore these conditions which should, in all cases, be corrected. The first essential in skin diseases of this kind, is spinal adjustment. In all cases adjustments of the 6th and 10th dorsal, and the 2nd lumbar vertebrae should be made; in addition to this, adjustments of the vertebrae producing an impingement upon the nerve govern-

ing the affected part of the body, should be made. In connection with this the hygiene should be corrected, suitable exercises should be prescribed, and the patient should be in the fresh air and sun-light as much as possible. Internal measures consist in a regulation of diet, attention to the bowels, and the use of mineral waters. Many cases of skin disease require the care of a specialist, and consultation with a dermatologist is advisable in many instances.

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